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MICHELBACHER (A. E.) & ROSS (E.). **The Giant Palm Borer (Coleoptera Bostrichidae) an economic Pest in Lower California.**—*Bull. Dep. Agric. Calif.* **28** no. 2 pp. 166–169, 3 figs., 8 refs. Sacramento, Calif., 1939.

The authors report that *Dinapate wrighti*, Horn, the larvae of which bore in *Washingtonia* (*Neowashingtonia*) *filifera* (*filamentosa*) in southern California, has been found in a locality in the north of Lower California in the same palm, which is used there for building material. Observations on this Bostrychid are briefly reviewed from the literature [*R.A.E.*, A **10** 364, 451; **12** 118; **16** 434].

WILSON (C. C.). **Grasshopper Surveys in California.**—*Bull. Dep. Agric. Calif.* **28** no. 2 pp. 170–173. Sacramento, Calif., 1939.

The methods recommended in this paper for surveying grasshoppers in California are essentially similar to those recommended in the United States generally [*cf. R.A.E.*, A **27** 76].

BAKER (E. W.). **A Note on the Occurrence of the Hollyhock Leaf Miner, *Tischeria omissa* Braun.**—*Bull. Dep. Agric. Calif.* **28** no. 2 p. 173. Sacramento, Calif., 1939.

In 1938, hollyhock leaves in Merced were mined by larvae of the Tineid, *Tischeria omissa*, Braun, which is common in California. The larvae enlarged their mines until they extended throughout most of the leaf, and spun a fine web in all the mined portion. Those that were observed in late June gave rise to adults by the first week in July. In late August, adults of the next generation were present, and larvae of a third generation were mining the newly-formed upper leaves. By this time most of the leaves had been killed.

About half the pupae examined were parasitised by a species of *Tetrastichus*, and about 6–8 parasites were present in each host.

JONES (G. D.). **Grasshopper Outbreaks in Missouri.**—*Bull. Mo. agric. Exp. Sta.* no. 406, 32 pp., 12 figs., 22 refs. Columbia, Mo., 1939.

The history of grasshopper outbreaks in Missouri shows that they occurred in 38 of the years from 1821 to 1938. The earlier records deal mostly with invading swarms of the Rocky Mountain Locust, *Melanoplus mexicanus*, Sauss., phase *gregaria* (*spretus*, Walsh), but it appears probable that, as in the recent outbreaks, various indigenous grasshoppers, including *M. differentialis*, Thos., *M. femur-rubrum*, DeG., *M. bivittatus*, Say, and *M. mexicanus* [phase *solitaria*] were partly responsible for the damage. A comparison of outbreak data with weather graphs shows that periods of 2 or 3 years of average or less than average rainfall favour the increase of the native grasshopper population to dangerous proportions. A dry autumn followed by a dry spring are particularly favourable for outbreaks. On the other hand, a very heavy infestation in 1938 was greatly reduced as the result of rainy and cool weather during May and June. On the whole, it is suggested that weather factors influence grasshopper abundance to a greater extent than parasites, agricultural practices and control operations.

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The use of poison baits was found to be a completely effective and relatively cheap method of protection, although it cannot lead to the complete eradication of grasshoppers.

JANNONE (G.). **Le cavalette nell'Africa Orientale Italiana.** [Locusts in Italian East Africa.]—*Circ. Cent. sper. agr. Afric. orient. ital.* no. 1, 23 pp., 1 fig. Addis Abeba, 1939.

A brief account is given of the morphology, bionomics and distribution of *Schistocerca gregaria*, Forsk., and *Locusta migratoria migratorioides*, R. & F., which are the commonest locusts occurring in Italian East Africa, and of measures for their control. The necessity for international co-operation in work against them in Africa is stressed.

VIDAL (J. P.). **Le faux tigre du poirier** (*Monostira unicostata* **Mls. Hem. Heter.**).—*Bull. Soc. Hist. nat. Afr. N.* **30** no. 1 pp. 27–32, 1 fig. Algiers, 1939.

All stages of the Tingid, *Monosteira unicostata*, Muls. & Rey, a pest of pears and other fruit trees in Morocco, are described, and notes are given on its bionomics and the injury it causes from observations made in a locality in eastern Morocco at an altitude of about 1,700 ft., where the climate is severe in winter and very hot in summer. In this locality, the Tingid has four generations a year ; the periods required for development of the various stages are much shorter than those given in papers already noticed [*R.A.E.*, A **26** 340 ; **27** 359]. A spray consisting of 5 lb. 40 per cent. nicotine sulphate, 1 gal. methylated spirit, 10 lb. Castile soap and 100 gals. water gave complete mortality of the nymphs, and successive applications at weekly intervals did not injure the foliage of pear.

ZOLOTAREVSKY (B. N.). **Le criquet nomade** (*Nomadacris septemfasciata* **Serv.**) **en Afrique française.**—*Bull. Soc. Hist. nat. Afr. N.* **30** no. 2 pp. 62–82, 1 pl., 14 refs. Algiers, 1939.

In French West Africa, *Nomadacris septemfasciata*, Serv., phase *solitaria* occurs from the Chad Colony to the Atlantic ; its southern limit is not known, but in the north it probably does not extend beyond the Sudanese zone. Some observations on it were made by the French locust research entomologists at Dia and Diafarabé in the inundation zone of the Niger in French Sudan, and at Agana and Am-Djéméné, both near the swamps in the neighbourhood of Lake Fitri, Batha, Chad Colony. At Am-Djéméné, adults were numerous in November 1935, and occurred almost exclusively on higher ground to the north-east of the swamp, covered by a dense growth of *Sorghum virgatum* mixed with *Oryza barthi*. Preliminary observations on microclimate suggested that this species preferred habitats characterised by medium humidity, in contrast to *Locusta migratoria migratorioides*, R. & F., which was most numerous at the driest observation points in the locality. *N. septemfasciata* was absent from densely wooded areas, though scattered trees were present at most of the points at which it was taken [*cf. R.A.E.*, A **24** 466].

The behaviour of all the individuals observed was characteristic of phase *solitaria*. A detailed biometrical study of them and a comparison of their ratios with those of both phases from different parts of Africa suggest that the appearance of phase *transiens* in the neighbourhood of Lake Fitri is possible [*cf.* **22** 620].

Though all the known outbreaks of *N. septemfasciata* phase *gregaria* have up to the present been confined to tropical Africa south of the equator, the identification of the species in the swarms in French Africa north of the equator is not always certain, and the damage to such plants as oranges, sweet potatoes and cassava proves that it cannot always have been *L. m. migratorioides*. The possibility that it may have been *N. septemfasciata* is not completely excluded. The data so far obtained are not sufficient to locate the outbreak centres of this species in French West Africa, or even to prove their existence. Nevertheless, recent work in Madagascar [**24** 236] and East Africa shows that the populations of *Nomadacris* may be built up under various ecological conditions, so that French West Africa cannot as yet be considered safe from outbreaks of it. In further investigations, special attention should be paid to all localities liable to flooding.

ZOLOTAREVSKY (B. [N.]). **Pullulation du criquet nomade en Afrique occidentale française.**—*Agron. colon.* no. 257 pp. 141–149, 1 map, 3 refs. Paris, 1939.

In continuation of investigations on *Nomadacris septemfasciata*, Serv., in French West Africa [*cf.* preceding paper], surveys were carried out in February and March 1939 between Macina in the south and Sa in the north, in the Niger inundation area, French Sudan. Examples of this locust were found in varying numbers throughout the area surveyed. In most cases they occurred on relatively dense but unentangled stands of *Andropogon*, 6–10 ft. in height. Very few were found on *Vetiveria nigritana* and none on *Echinochloa stagnina*. The locusts were most numerous in a belt about 30 miles wide to the south of Lake Debo, where the course of the river Niger is broken by wooded islands surrounded by large stretches of land barely covered by floods and cut up by numerous channels and rivulets. The depressions are overgrown by *V. nigritana*, but the higher ground bears uniform stands of *Andropogon*, and here the population of locusts was sufficiently dense to resemble small aggregations of phase *gregaria*. Further south, few locusts were found, for there the *Andropogon* stands are confined to bluffs overlooking streams, and although the stands reappear in the region of Diafarabé and Macina, they consist of different species forming a more tufted and entangled growth. North of Lake Debo, *N. septemfasciata* was exceedingly rare.

All the examples collected during the survey belonged to phase *solitaria*. Nevertheless, the increase since early 1938 in the population of this species in the inundation zone and its presence in large numbers in a well-defined and restricted area indicate that breeding up is taking place, which may terminate in the appearance of swarms of phase *gregaria*. The measures taken to ensure the destruction of the swarms of *N. septemfasciata* that may appear in the inundation area have been facilitated by the existence there of an organisation for the control of the outbreak area of *Locusta migratoria migratorioides*, R. & F. The possibility of swarms developing in other parts of French West Africa cannot be excluded, and further surveys should be carried out within the Niger inundation zone and at Lake Fitri, Chad Territory [*cf.* preceding paper], as well as in the lowlands between the river Logone and the sources of the Benue, in the Cameroons, and in the valleys of the rivers Senegal and Casamance.

Bouet (G.). **Etat actuel du problème des acridiens migrateurs en Afrique. (Recherches et travaux de la Mission française en Afrique française.)**—19 pp., 3 maps. Paris, Soc. Edit. géogr. marit colon. [1938.]

In this paper, the author outlines the locust problem in French North and West Africa, the organisation of research there, and the results of investigations [*cf. R.A.E.*, A **27** 11–14, 480, 481, 487].

Henrard (P.). **Le cycle vital de la teigne du cotonnier au Congo belge.** —*Rev. Zool. Bot. afr.* **32** fasc. 1 pp. 19–20, 1 ref. Brussels, 1939.

A summary is given of observations on the life-cycle of *Platyedra gossypiella*, Saund., in the cotton-growing regions in the north of the Belgian Congo, where it is very widespread. Larvae collected in the field at the end of February were placed in cages, and all adults emerging on the same day were kept in a well-aired cage for four days, during which time pairing usually took place. They were then placed individually in tubes. All adults were fed on diluted honey. The young larvae were kept in individual tubes with a cotton boll, which was changed whenever necessary. The average and maximum numbers of eggs laid by a female at one time were 35 and 54, and the average and maximum total numbers of eggs laid, 70 and 75. These are certainly lower than the corresponding numbers laid in the field. The egg, larval and pupal stages lasted 5–6, 12–16 and 9–12 days, and the preoviposition period about 10 days. As cotton in this district is in a condition suitable for the development of *P. gossypiella* for four months, it is concluded that three generations can develop in one season.

Ghesquière (J.). **Un nouveau parasite extracongolais.**—*Rev. Zool. Bot. afr.* **32** fasc. 1 p. 143. Brussels, 1939.

The Pyralid, *Crocidolomia binotalis*, Zell., which had not previously been recorded in the Belgian Congo, was discovered in the western part of the Colony in October 1935. All cruciferous vegetables and particularly cabbages in the infested area were severely attacked.

Bedford (H. W.). **Entomological Section, Agricultural Research Service. Report . . . 1936–37.**—*Rep. agric. Res. Serv. Sudan 1937* pp. 50–65, 1 fldg map. [Wad Medani, 1938.]

Notes are given on the local incidence of the usual insect pests of cotton and *Sorghum* in the Anglo-Egytian Sudan during 1936–37; all of them have been recorded in previous reports [*R.A.E.*, A **25** 216; **26** 511]. Larvae of *Platyedra gossypiella*, Saund., were observed at the end of July in up to 30 per cent. of the fruits of *Hibiscus esculentus* in districts in the Gezira in which the regulations prescribing the destruction of this plant during the dead season for cotton had been disregarded, and during October in 4 per cent. of those examined in the northern Sudan, where fruits of *Sida* sp. were also attacked to a minor degree. Under experimental conditions, emergence of adults from double seeds of cotton containing resting larvae was greatest at 85°F. and 80 per cent. relative humidity, and was considerably reduced at higher temperatures combined with lower humidities. In the Nuba Mountains, most larvae in stored bolls entered into diapause during December, and maximum emergence took place

between mid-June and mid-July ; emergence in the Gezira was slightly later. No adults from overwintered larvae emerged from infested bolls collected in Equatoria Province in November 1935, but two adults emerged in May 1936 from bolls collected during the previous December. Adults failed to emerge from bolls buried 4 ins. below the soil surface or exposed on it for a long period in Equatoria and the Nuba Mountains, but in the latter, 4 adults emerged in July 1936 from a sample of boll refuse from a pile a foot high found in the field in April. Increased infestation in fields remote from human habitation was less marked than during the previous year [**26** 511], and the improvement is attributed to better cutting out of cotton sticks ; the highest infestations appeared to be near Arab villages, where American cotton is now more widely grown. Resting larvae were destroyed by treating seeds for sowing in a mechanical seed heater or by exposing them to the sun.

In the Nuba Mountains, adults of *Diparopsis castanea*, Hmps., from resting pupae of the previous season emerged during June–August, and larvae of three overlapping generations occurred on cotton during August–November. Of the individuals of these generations, 58·0, 31·4 and 25·0 per cent., respectively, developed without a pupal diapause, the egg, larval and pupal stages lasting 3–4, 12–17 and 14–15 days. Alternative food-plants of this bollworm were recorded in the Nuba Mountains for the first time ; 3·5, 6–20 and 4 per cent. of the fruits of *Hibiscus sabdariffa*, *H. cannabinus* and *Hibiscus* sp. were found to be infested by it. In Northern Province adults emerged from the soil in June ; pupation took place in the upper 6 ins. of soil. Further comparisons of 9 cultural methods of control confirmed the results obtained in 1935–36 [**26** 511] ; heavy watering was completely effective.

Bollworms, particularly *Heliothis armigera*, Hb., were responsible for 1–21 per cent. of the total shedding of buds and bolls in the Shendi and Berber districts, while in the south, excessive shedding was attributed to *H. armigera* and *Earias insulana*, Boisd., although very few larvae were present in boll samples. In one locality in the Nuba Mountains where shedding was particularly heavy, only 13·8 per cent. of it was due to bollworms and a better crop was subsequently obtained than in another district in which shedding was light, but almost a third of it was due to bollworm activity.

Dysdercus fasciatus, Sign., was the predominant cotton stainer in the Nuba Mountains, except in one locality in which *D. superstitiosus*, F., was six times as numerous and migrated to cotton from tebeldi [*Adansonia digitata*] in October before the application of the second spray. Infestation by it was highest in December. In Equatoria Province, *D. superstitiosus* was ten times as numerous as *D. nigrofasciatus*, Stål. Infestation of cotton sown in June and July was observed during August–September and October, respectively, and reached a maximum during October and December. The abundance in this area of alternative food-plants (*Hibiscus*, *Sterculia* and kapok), on which *D. superstitiosus* bred during July–September, hinders effective control. Observations in the Nuba Mountains indicated that some but not all plants of *Adansonia digitata* become reinfested by *D. fasciatus* or *D. superstitiosus* each year. Adults of *D. superstitiosus* bred on *Hibiscus esculentus* during September, and others were observed on other species of *Hibiscus*. Adults and nymphs occurred in October on ground-nuts (*Arachis hypogaea*) that were not

associated with cotton or other malvaceous plants. The presence in June of *D. superstitiosus* on uncut cotton in a district from which *A. digitata* was absent indicated that it can survive in the absence of the latter. Pollarding *Adansonia* trees and spraying them during June–July and again from September to mid-October were both effective in controlling stainers, but a single early spray was unsatisfactory. The predacious Reduviid, *Phonoctonus lutescens*, Guér. & Perch. [**21** 485], was successfully bred in the laboratory, and one adult destroyed 56 stainers in 22 days. Of 1,450 adult stainers examined in Equatoria Province, 2·3 per cent. were parasitised by Tachinid larvae or *Mermis* sp.

Cotton sown in June and mid-July in Equatoria Province became infested by *Helopeltis bergrothi*, Reut., in mid-July and early August, respectively; during August–October, cotton was the preferred foodplant of the bug, and maximum infestation occurred in November, when over 1,000 adults per acre were observed. In December, infestation on cotton was low, but had increased slightly on other foodplants. The presence of weeds, particularly in the early stages of the crop, appeared to favour infestation. Adults oviposited on *Solanum aethiopicum* during June–July, and on *Corchorus* sp., guava (*Psidium guayava*) and *Acalypha senensis* during August. In experiments, cotton sown late (August) was more severely damaged than that sown early. The severity of attack on plots sown at the same time and receiving similar cultural treatment was very variable and appeared to be related to the intensity of cropping to which the soil had previously been subjected. On soil that had borne cotton since 1933–34, damage by *Helopeltis* was severe and 50–60 per cent. of the plants produced no crop, whereas on soil bearing cotton for the first time, the total loss did not exceed 1 per cent. Since the amount of damage varied in three blocks of plots that were sown with cotton for the first time in 1936–37 and had previously borne other plants, susceptibility to attack was thought to be related to some kind of soil deficiency, but analyses of samples of soil and of leaves and stems from healthy and injured plants failed to indicate any appreciable deficiency; soil from affected plots, however, showed an acid reaction. The yields from 10 heavily distorted and 10 healthy plants were 76 and 217 bolls, respectively. When bolls were exposed to attack by 5 individuals of *Helopeltis* for 24 hours, 16–42 per cent. failed to open, the percentage being proportional to the size of the bolls.

The condition known as " crazy top " was very prevalent on cotton in some areas in Northern Province, where shortening of the internodes followed by sterility first appeared in October. Cage experiments to ascertain whether it was due to a disease caused or transmitted by *Bemisia gossypiperda*, Misra & Lamba, *Empoasca lybica*, Berg., or *Campylomma nicolasi*, Puton & Reut., were inconclusive, as other insects gained access to the cages; symptoms resembling those of " crazy top " were, however, observed in some of the cages. Another experiment indicated that the condition was not due to irregular irrigation.

Observations on *Sesamia cretica*, Led., which is the most important pest of *Sorghum* in Northern Province, have shown that exposing cut stalks, in a thin layer, to the sun destroys most of the larvae and pupae, which otherwise survive the winter in them. Parasitism of the eggs during the period November–January by the Scelionid, *Platytelenomus hylas*, Nixon [*cf.* **25** 218], exerted a controlling influence.

Janjua (N. A.). **Codling Moth in Afghanistan.**—*Curr. Sci.* **7** no. 3 pp. 115–116, 3 refs. Bangalore, 1938.

The examination in 1935 of apple orchards at Kandahar, Ghazni and Kabul showed that most of the apples in them had been attacked by *Cydia pomonella*, L. [*cf. R.A.E.*, A **26** 340], and adults were reared from larvae taken from infested fruits. In March 1938, overwintered larvae from Kandahar also gave rise to adults of *C. pomonella*.

Lal (K. B.). **Identity of two important Parasites hitherto considered as distinct Species.**—*Curr. Sci.* **8** no. 3 pp. 125–126, 4 refs. Bangalore, 1939.

In view of the difficulty in distinguishing *Microbracon lefroyi*, D. & G., which parasitises *Earias* spp. and *Platyedra gossypiella*, Saund., on cotton in India, from *M. greeni*, Ashm., an important parasite of *Eublemma amabilis*, Moore, and *Holcocera pulverea*, Meyr., which are predacious on the lac insect, *Laccifer lacca*, Kerr., examples of the two Braconids were compared. There was no constant morphological character by means of which they could be distinguished, but as they do not usually oviposit on the same host [*cf. R.A.E.*, A **25** 635], it is considered that *lefroyi* is a race of *M. greeni*.

Isaac (P. V.). **How Mid-rib Hardness affords Resistance to the Sugar-cane Top-borer,** *Scirpophaga nivella* **F., in India.**—*Curr. Sci.* **8** no. 5 pp. 211–212. Bangalore, 1939.

The sugar-cane top-borer, *Scirpophaga nivella*, F., occurs throughout India, and in some districts attacks up to 70 per cent. of the canes. Infested canes become stunted and often develop a bunchy top owing to the growth of branches from the upper side buds. The shoots dry up and many die. The percentage loss in weight at harvest due to this borer averages 20 and is considerably higher in some years.

Observations at New Delhi in 1937–38 showed that the varieties of cane that show resistance to attack all have leaves with very strong hard mid-ribs, whereas the leaves of susceptible varieties have weak mid-ribs and often droop. The larvae of *Scirpophaga* first bore into the mid-ribs and then down them into the shoots. If they are unable to enter the mid-ribs, they die through exposure and lack of food, without seeking another leaf. Experimental cultivation in 1937–38 gave statistically significant differences in favour of varieties with strong mid-ribs, and in Bihar early in 1939, in a sugar-cane field about to be harvested, the percentage infestation in millable canes was 17 in the variety Co. 513, which has a strong mid-rib, and 71 in Co. 210, in which the mid-rib is weaker.

Cherian (M. C.) & Basheer (M.). *Brachymeria excarinata*, **Gahan (Family Chalcididae) a pupal Parasite of** *Plutella maculipennis* **Curtis in South India.**—*Proc. Indian Acad. Sci.* **7** (B) no. 6 pp. 289–299, 1 pl., 3 refs. Bangalore, 1938. *Tetrastichus sokolowskii* **Kurdj. (Family Eulophidae) a larval Parasite of** *Plutella maculipennis* **in South India.**—*Op. cit.* **9** (B) no. 2 pp. 87–98, 6 figs., 4 refs. 1939.

In these two papers are recorded laboratory observations carried out in South India mainly in 1937 on the bionomics of *Brachymeria*

excarinata, Gah., and *Tetrastichus sokolowskii*, Kurdj., which parasitise *Plutella maculipennis*, Curt., a common pest of cruciferous vegetables.

In the first paper, the life-history of the host is briefly summarised. At Coimbatore, the life-cycle lasted 15–18 days in September and October 1937. All stages of *B. excarinata* are described. The adults pair and females oviposit on the day of emergence. The eggs are deposited in the pupae of the host, the maximum total and daily numbers of eggs laid by a single female being 213 and 16, respectively. When only one host pupa was available, the female oviposited in it more than once, but in such cases no adult parasites emerged. Pupae may be parasitised by more than one female, and those of all ages are acceptable, except those that are very advanced. Parthenogenesis also occurred, the progeny being exlusively male. The egg stage lasted 1–2 days, and the egg and larval stages together 6–8 days. Larvae pupate within the host, and the adults emerge after 4–7 days. Females that were fed on honey solution and oviposited survived for an average of 14 days, while those that were kept without food died within 4 days. The maximum percentage parasitism in pupae collected in the field was 59·9, in August. In September, October and November, the percentages were 15·5, 22·6 and 20·4, respectively.

In the second paper, brief descriptions are given of all stages of *Tetrastichus sokolowskii*. Females of this Eulophid oviposited on the day of emergence in the larvae of *P. maculipennis*, the maximum total and daily numbers of eggs laid being 127 and 25. Several females oviposited in a single host larva, and the maximum number of adult parasites that emerged from a pupa of the host was 39. Not more than 13, however, emerged from pupae collected in the field. Parthenogenesis was common, the progeny being males. Females kept without food lived for 4 days, and those fed on honey solution for up to 20. The eggs hatched in less than 2 days, the egg and larval stages together lasted 5–8 days, and the pupal stage 5–7. The percentage parasitism in pupae collected in the field was highest (68·5) in November and lowest (18·2) in August. A list is appended of other species of *Tetrastichus* that have been recorded from economic hosts in South India.

Agriculture and Animal Husbandry in India 1936–37.—503 pp., 3 pls. Delhi, 1939.

Much of the information on insect pests (pp. 216–231) in this review of work in India, mostly in 1936–37, has already been noticed. *Emmalocera depresella*, Swinh., was the commonest borer on young sugar-canes at Delhi. In the United Provinces, experiments showed that very late sowing resulted in increased attack by moth-borers. Rains in May and June reduced infestation by *Argyria sticticraspis*, Hmps., from 20–30 to 10 per cent. and hindered the spread of *Pyrilla*. Early earthing protected young stalks from attack by *A. sticticraspis* during the hot weather, and attack by *Pyrilla* was reduced by stripping and removing dry leaves late in the season.

In the Punjab, investigations over about six years have shown that though the white-fly of cotton [*Bemisia gossypiperda*, Misra & Lamba] causes serious losses, it is not solely responsible for " failure " of cotton crops. Measures found of value against the pink bollworm [*Platyedra gossypiella*, Saund.] included sun- or machine-heating of the ginned seed in the United Provinces, destroying shed material from the cotton

fields on all mornings following windy, rainless nights between October and the end of December in the Central Provinces and Berar, and removing stalks soon after picking, completing ginning before May and prohibiting the cultivation of *Hibiscus esculentus* in the hot weather in Hyderabad-Deccan, where the bollworm overwinters in the soil and does not survive in stored seed.

Spodoptera mauritia, Boisd., on rice in Assam, was controlled by catching adults in Andres-Maire traps [*cf. R.A.E.*, A **1** 507; **3** 320], destroying the larvae by hand or by flooding, and exposing and killing the pupae. The life-cycle of *Pachydiplosis oryzae*, Wood-Mason, which caused the condition known as gangai disease or silvery shoot in rice, was found to last 14-21 days in the Central Provinces during August–November. Adults of this Cecidomyiid were bred from galls on grasses found in and near rice-fields after harvest. Early ripening varieties of rice were attacked less than late ones. Two Chalcidoids, one of which parasitised the pupae of *P. oryzae*, and *Platygaster* sp., which parasitised the eggs, were reared from infested rice plants. Heavy rainfall when the adults of the Cecidomyiid were emerging prevented subsequent attack, and the large numbers of *Platygaster* may have exerted some control. *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) on rice at Coimbatore was parasitised by *Trichogramma* sp. and *Tetrastichus* sp. from December onwards.

In the United Provinces, migration of *Eriosoma lanigerum*, Hsm., between the roots and shoots of apple ceased only for about two months during the coldest weather. It had no alternative food-plant, and asexual females were present on the trees throughout the year. Collection of egg-masses and nests gave effective control of *Malacosoma* (*Clisiocampa*) *indica*, Wlk., the larvae of which fed on the leaves of apple, pear, cherry and plum. In the Madras Presidency, *Dacus* (*Chaetodacus*) *ferrugineus*, F., infested fruits of *Solanum auriculatum* throughout the year. The larvae were parasitised by *Opius incisi*, Silv., *Biosteres* (*Opius*) *longicaudatus*, Ashm., and *B.* (*O.*) *persulcatus*, Silv., and the pupae by *Spalangia philippinensis*, Fullaway, and *Dirhinus auratus*, Ashm. In Baluchistan, *Spilonota ocellana*, Schiff., and *Tortrix* (*Cacoecia*) *subsidiaria*, Meyr., caused serious injury to the blossoms of apple, plum and apricot, *Dacus ferrugineus* and *D.* (*Chaetodacus*) *zonatus*, Saund., infested the fruits of peach, apple, pear and pomegranate, and *Myiopardalis pardalina*, Big., and *D.* (*C.*) *cucurbitae*, Coq., attacked melons.

Plusia orichalcea, F., which damaged the leaves of flax in Bengal, was controlled by hand-picking and spraying with lemon chrome [barium chromate], and *Zeuzera coffeae*, Nietn., on coffee in Central Travancore and the Anamalais, by cutting off and burning infested branches, and injecting petrol into the tunnels below pruning level. The Acridid, *Poecilocerus pictus*, F., defoliated *Calotropis gigantea* at New Delhi and then attacked various crops, particularly egg-plant (*Solanum melongena*).

Oosterling (H.). **Het hars- en terpentijnbedrijf in Nederlandsch-Indië.** [The Resin and Turpentine Industry in the Netherlands Indies.]—*Landbouwk. Tijdschr.* **50** no. 611 pp. 373–391. Wageningen, 1938.

In the Netherlands Indies, the conifer yielding the balsam from which resin and turpentine are obtained is *Pinus mercusi*. It has few

insect pests, but these occasionally increase in numbers and cause injury in unmixed stands. The two commonest, which cause considerable loss by defoliating the trees, are the Geometrid, *Milionia basalis*, Wlk., and a Psychid. Measures promoting vigorous growth are recommended.

Hille Ris Lambers (D.). **Bladluizen en virustransport.** [Aphids and Virus Transmission.]—*Landbouwk. Tijdschr.* **50** no. 619 pp. 1057–1062. Wageningen, 1938. (With a Summary in English.)

Notes are given on the bionomics of Aphids that are known or suspected to be vectors of virus diseases of potato in Holland [*cf. R.A.E.*, A **15** 509; **17** 249]. The commonest of these is *Myzus persicae*, Sulz., which hibernates in the egg stage on peach. Between mid-May and mid-June, winged forms develop on peach and fly to potato and other plants, on which infestation increases rapidly. It is further spread by winged forms produced on potato in summer, and those that appear in autumn fly back to peach. Viviparous parthenogenetic reproduction occurs throughout the summer, and in exceptional cases may continue in winter, either in greenhouses or, as reported in England, on cabbage and related plants [**21** 126]. *Aphis* (*Doralis*) *rhamni*, Boy., is occasionally numerous on potato, forming dense colonies on the lower leaves. The winter eggs occur on *Rhamnus frangula* and *R. cathartica*, of which the former is common. *Macrosiphum solanifolii*, Ashm., prefers the upper parts of the plant, especially the blossoms. It can hibernate in the egg stage, probably on a number of plants, and viviparae overwinter in greenhouses. *M.* (*Aulacorthum*) *solani*, Kalt., is especially common on potato in the clay and peat districts in northern Holland, and the winter eggs are deposited on a large number of different plants. In south-western Holland, *Rhopalosiphoninus latysiphon*, Davidson, is sometimes very abundant on the roots and underground parts of the stems of potato, but it is not known whether this species transmits a virus.

The mobility of the apterous forms is discussed. It is greatest in *M. solanifolii*, apterae of which colonised 168 plants from 3 infested ones in 13 days. *A. rhamni* is the least mobile. In the case of *M. persicae*, regular counts were made in an infested potato field. The last winged migrants from peach were observed on 16th June, when 70 per cent. of the plants were infested. No further alates were observed, but the percentage infestation rose to 99 by 26th June. The chief factors that influence the spread of infestation by Aphids are climate, predators and entomogenous fungi. It is considered that the best method of controlling virus diseases of potato is to control their Aphid vectors, and that this could best be done, especially in the case of *M. persicae*, by applying tar-distillates against the winter eggs.

Bos (J.). **Enkele opmerkingen over wormstekigheid bij appel in Nederland.** [Observations on the Activity of the Codling Moth in the Netherlands.]—*Tijdschr. PlZiekt.* **45** pt. 3 pp. 93–105, 1 pl., 9 refs. Wageningen, 1939.

The results are given of observations in Holland in 1933–37 on the bionomics of *Cydia* (*Carpocapsa*) *pomonella*, L., on apple. The moths began to emerge in the fruit stores on 27th May in 1934 and 12th June

in 1935, and in the open on 7th, 1st, 21st, 19th, and 14th June in the 5 years of the observations, respectively. Adults were present in the orchard up to 24th June in 1934 and 27th July in 1935. A few adults were also present from 3rd to 27th August in 1935, indicating the possible occurrence of a small second generation. The eggs were laid on the leaves and sometimes on various parts of the fruits, and the larvae, which hatched in about 8 days, entered the apples at the side more often than through the calyx. In tests on the use of a lead arsenate spray, a single application 4–5 weeks after blossoming was the best treatment, and reduced the numbers of infested fruits by 50 per cent. More larvae were caught in trap bands of corrugated cardboard than in those of jute sacking. A few larvae were parasitised in 1934 and 1936 by *Pristomerus vulnerator*, Panz.

Schwerdtfeger (F.). **Probesuchen nach Eiern der Forleule.** [Sample Collections of Eggs of the Pine Noctuid.]—*Merkbl. Inst. Waldschutz Eberswalde* no. 1, 4 pp. Eberswalde, 1938.

In the case of a threatened outbreak of *Panolis flammea*, Schiff., on pines, the number and condition of the eggs on the needles can be used as a basis for a final forecast. In this leaflet, detailed instructions are given to foresters in Prussia as to the methods to be followed in carrying out such a count. Observations have shown that in Prussia it is best done in mid-May, about 10–15 days after adult flight has reached its maximum, as then oviposition is completed but the eggs have not yet hatched.

Gäbler (H.). **Das Eindringvermögen verschiedener Flüssigkeiten in die Tracheen und seine Folgen.** [The Capacity of various Fluids to penetrate the Tracheae and its Consequences.]—*Z. angew. Ent.* **26** pt. 1 pp. 1–62, 32 figs., 40 refs. Berlin, 1939.

A detailed account is given of investigations on the power of penetration into the tracheae of various insects of a number of fluids possessing a greater or less wetting capacity and also the phenomena consequent on such penetration and on penetration confined to a few stigmata. Preliminary tests were also made with spray solutions to gauge their behaviour in this respect. The effectiveness of a spray may largely depend on its ability to wet the surface of plants and insects, particularly as wetting capacity enables a contact insecticide to penetrate the tracheae.

The structure and function of the respiratory system of insects are described, with special reference to the tracheal stigmata, the literature on the wetting power of fluids is briefly reviewed, and published methods for testing it are discussed. In his experiments, the author used Trappmann's paraffin test plates, prepared by dipping pieces of cardboard in a 20 per cent. solution in chloroform of paraffin wax (melting at 58–60°C.) and allowing the solvent to evaporate. He also used living adults of *Melasoma tremulae*, F., which were immersed in the fluids or had the latter applied to their elytra or backs. A table shows the results given by 16 proprietary insecticides and absolute alcohol, liquid paraffin, castor oil, oil of turpentine, methylated spirit, and 25 per cent. soap solution. Other tests were made with a Traube stalagmometer, from which the fluid flows in drops of which the size increases with the surface tension. Tests of mixed fluids showed that a comparatively small addition of a fluid with low

viscosity to one of high viscosity causes a great decrease in the viscosity of the latter.

Preliminary experiments were made on the action of the liquids as actual respiratory poisons by exposing test insects, mainly *M. tremulae*, to the vapours from them in glass tubes. Death ensued in 4 hours with methylated spirit and with one proprietary insecticide. With other substances, periods of up to 96 hours were needed, and with castor oil, liquid paraffin, Flit and another commercial preparation the beetles were still alive after 144 hours. Comparative tests with larvae of the lesser wax moth, *Achroia grisella*, F., showed that insects vary in sensitivity. In some cases, the vapour condensed on the sides of the glass tubes, and liquid methylated spirit was found to have entered the tracheae by this means.

Tests of penetration into the tracheae were made by immersing the test insects in the fluids either until they died or for periods of 17–22 hours, or by imbibition experiments in which either the whole of the back or a limited number of stigmata were wetted. The methods used and the results obtained are discussed with reference to the results of other investigators. It is concluded that contact insecticides may be classified into those with which simple contact with the surface of the body suffices and those that act only within the tracheae, *i.e.*, through the thin tracheal walls and the terminal tracheal cells.

In a discussion of the action of certain proprietary insecticides, it is stated that the vapour of Flit was harmless to adults of *M. tremulae*, but that if a sufficient amount was used the fluid filled the tracheae and death occurred rapidly. The German product known as "Cuprex" [*R.A.E.*, B **27** 171] was able to penetrate the tracheae of insects dipped in it; the rapidity of death pointed to toxic action as well as to suffocation. "Xylamon Spezial Natur," used to impregnate wood, had little wetting power, but nevertheless penetrated deeply into the tracheae of insects dipped in it. As adults of *M. tremulae* died in 72 hours when merely exposed to its vapour, there must be some respiratory action [*cf.* A **27** 202, 520]. The imbibition experiments showed the importance of penetration into the tracheae, and to achieve this a liquid should have only slight surface tension and slight viscosity.

The deformations of the stigmata in Lepidoptera and Coleoptera due to imbibition are described, and, in the case of *A. grisella*, compared with those due to needle punctures. The deformation of other organs and discoloration due to imbibition through the tracheae, and regenerative processes in the stigmata and other organs are discussed.

VON FINCK (E.). **Untersuchungen über die Lebensweise der Tachine *Parasetigena segregata* Rond. (=*Phorocera agilis* R.-D.) in der Rominter Heide (1935) sowie einige Beobachtungen über Schlupfwespen. (Die Parasitierung der Nonne durch Insekten. Teil I.)** [Investigations on the Biology of the Tachinid, *Phorocera silvestris* R.-D. in the Rominten Heath District in 1935, with some Observations on Hymenopterous Parasites. (The Parasitisation of the Nun Moth by Insects. Part I.)]—*Z. angew. Ent.* **26** pt. 1 pp. 104–142, 14 figs., 11 refs. Berlin, 1939.

This detailed account of the author's investigations in the spruce forests at Rominten, East Prussia, made in 1935 as a result of a

serious outbreak of the nun moth [*Lymantria monacha*, L.], comprises observations on the biology, local distribution and increase of the Tachinid, *Phorocera silvestris*, R.-D. (*Parasetigena segregata*, auct.) and brief notes on some other parasites of the nun moth. It is pointed out in a footnote that some authorities consider *Phorocera agilis*, R.-D., to be the correct name for the Tachinid in question.

The following is taken largely from the author's summary, which includes information already noticed from another source [*R.A.E.*, A **24** 751] : Descriptions are given of the flight of the males near the ground and in the trees, the flight of the females in the tree crowns, and the process of pairing. Captive males lived for an average of 27 days, and females for 35 days. Three females began to oviposit after 8–10 days. The maximum total and daily numbers of eggs per female were 218 and 33, respectively, and the daily average was 6. Host larvae in the later instars were preferred for parasitism. The parasites left the dead host larvae and pupated in the ground between 3rd July and 14th August, and this period coincided approximately with the pupation of the nun moth. Between the late summer of 1934 and the spring of 1935, the percentage mortality of the Tachinid pupae in the soil averaged 19, while a mortality of 14 per cent. was observed early in September in pupae formed in 1935. Particulars are given of the distribution of *P. silvestris*, based on the numbers of puparia in the soil and of adults caught in traps, in four localities in the district. In one of them, the percentage parasitism by it of *L. monacha* varied from 4·4 to 45, and in another it was less than 1.

Tachinids other than *P. agilis* were rare ; they included one species, *Zenillia* (*Carcelia*) *lucorum*, Mg., known to parasitise *L. monacha*. Sarcophagids were more abundant, but their larvae were found only in dead larvae of the moth. Ichneumonid parasites of *Lymantria*, which occurred in very small numbers, included *Pimpla instigator*, F., *P. examinator*, F., *P. capulifera*, Kriechb., and *Ichneumon disparis*, Poda.

Niklas (O. F.). **Zum Massenwechsel der Tachine** *Parasetigena segregata* **Rond.** (*Phorocera agilis* **R.-D.**) **in der Rominter Heide. (Die Parasitierung der Nonne durch Insekten. Teil II.)** [The Variation in Abundance of the Tachinid *Phorocera silvestris* R.-D. in the Rominten Heath District. (The Parasitisation of the Nun Moth by Insects. Part II.)]—*Z. angew. Ent.* **26** pt. 1 pp. 63–103, 17 figs., 31 refs. Berlin, 1939.

The following is based on the author's summary of the results of investigations on *Phorocera silvestris*, R.-D. (*agilis*, auct.) carried out in 1936 and 1937 in continuation of those of von Finck [see preceding abstract] : Mortality of the pupae in the ground is due to natural enemies, internal causes and climate, and adult emergence is dependent on soil temperature. Most vital processes, such as flight and pairing, depend on solar radiation. All the females are usually fertilised, but unfavourable climatic conditions sometimes reduce the proportion of the males. The flight of the adults in the tree crowns is repeated daily. In areas heavily infested by the nun moth [*Lymantria monacha*, L.], the density of the pupae in the ground increases little from year to year, but in areas of slight infestation it increases so rapidly that an immigration of the Tachinids must be assumed. Adult flight near the ground is common in heavily infested areas, while flight in the tree

crowns (and consequently oviposition) is greater in slightly infested areas. In areas of heavy infestation, the larvae of *L. monacha* suffer from polyhedral disease, and there may be divergences from the rule that older larvae are chosen for parasitism, since heavily diseased fifth-instar larvae are not parasitised. The high incidence of polyhedral disease in heavily infested areas causes many of the Tachinids to migrate to the less infested areas. Mortality in the eggs and larvae of the Tachinid may be caused by climate, natural enemies, disease of the host larvae, and the lack of synchronism between host and parasite. The mass increase of the Tachinid varies locally and is dependent on the population of the moth. As the collapse of an outbreak of the latter, due to polyhedral disease, causes the Tachinid to migrate, the populations of both decrease in the same year. A slow increase of the moth, with only slight incidence of disease, provides the Tachinid with favourable conditions for multiplication. It is attracted thereby, and continues to increase until the year following the fall in the population of the moth.

Götz (B.). **Untersuchungen über die Wirkung des Sexualduftstoffes bei den Traubenwicklern** *Clysia ambiguella* **und** *Polychrosis botrana*. [Investigations on the Action of the Sex Scent in the Vine Moths, *C. ambiguella* and *P. botrana*.]—*Z. angew. Ent.* **26** pt. 1 pp. 143–164, 6 figs., 21 refs. Berlin, 1939.

Data on the sex scents of Lepidoptera are reviewed, and an account is given of experiments at Geisenheim, on the Rhine, in which living females of the vine moths, *Clysia ambiguella*, Hb., and *Polychrosis botrana*, Schiff., were used to attract the males. It had previously been observed that trap jars often contain many males, with only one or a few females. Laboratory work showed that the scent is produced, chiefly towards the evening, by sexually mature unfertilised females. It is imperceptible to man, but attracts the males of the species to which the female belongs, and it persists in a jar in which a female has previously been confined. The effect was cumulative; three females of *P. botrana* were found to stimulate the males more than a single one. The field experiments showed that the scent is more attractive to the males than a mixture of wine, vinegar and sugar, which is the most effective bait hitherto known, and that its effect extends to a distance of at least 21 yards for *P. botrana* and 27 yards for *C. ambiguella* [*R.A.E.*, A **27** 466]. These results indicate the possibility of using the sex scent in control; as the males generally appear before the females, it is considered that the majority could be caught before pairing.

Claus (A.). **Ueber weitere Prüfungen des Präparates Naaki als Kornkäferbekämpfungsmittel im Jahre 1938.** [On further Tests of Naaki against *Calandra granaria* in 1938.]—*Z. angew. Ent.* **26** pt. 1 pp. 165–170. Berlin, 1939.

The following is based on the author's summary of further investigations, made in 1938 in North Germany, on the insecticidal effect on the grain weevil [*Calandra granaria*, L.] of Naaki, a silicic acid powder [*cf. R.A.E.*, A **24** 341, 814; **25** 528]: A ridge of Naaki 4–6 ins. high can be crossed by the adults of *C. granaria*. More living than dead weevils were found in warehouses in which the

powder had been used according to instructions for 13 weeks. Partial control was observed in some cases, but this was probably due to repeated applications over a period of years or to the fact that the store had been thoroughly cleaned, well dusted with the powder and then left empty for at least the summer months. Larval feeding was not interrupted by dusting. Naaki does not give direct control, but it can be used as a preventive or supplementary measure in certain cases in which the use of sprays or fumigants is not feasible. Successful eradication of the weevil by means of it is not possible, at least in damp coastal districts.

STEINER (P.). **Bekämpfung von Spinnmilben durch Klebmittel.** [The Control of Spinning Mites by Means of Adhesives.]—*Z. angew. Ent.* **26** pt. 1 pp. 180–183, 2 figs., 3 refs. Berlin, 1939.

Sprays forming an adhesive coating have proved effective against *Tetranychus telarius*, L., in the United States, one such spray consisting of 1½ lb. glue in 10 U.S. gals. water [*R.A.E.*, A **22** 531], and in experiments in Germany, the author obtained good results against it on *Hydrangea hortensia* with a 0·5 per cent. solution of gelatine. A weaker solution may fail to hold the mites, while a stronger one causes the leaf-buds to adhere together. To ensure better wetting power, 0·25 per cent. of a proprietary oil was added. Two applications are necessary, the second 8–10 days after the first.

FLACHS (K.). **Die Kartoffelmotte (*Lita solanella* Boisd.).** [The Potato Moth, *Phthorimaea operculella*, Zell.]—*Prakt. Bl. Pflanzenb.* **17** pt. 1–2 pp. 1–5, 5 figs., 17 refs. Munich, 1939.

A brief account is given of the distribution, morphology, bionomics and control of *Phthorimaea operculella*, Zell. (*Lita solanella*, Boisd.), which is a pest of potato in warm climates, but has been observed occasionally in Germany in imported tubers. In store-rooms, females lay about 80 eggs in hollows on the tubers. The larvae hatch in 3 days and bore into the tubers. At a temperature of 18–20°C. [64·4–68°F.], the larval and pupal stages lasted 14 and 20 days, respectively.

FEYTAUD (J.). **Etat actuel de la question doryphorique en Europe.**—*Sciences* **66** no. 29 pp. 259–263. Paris, 1939. **Conseils pour la défense des cultures de pomme de terre menacées par le doryphore.**—*T.c.* pp. 264–268.

In the first paper, a brief account is given of the spread of *Leptinotarsa decemlineata*, Say, on potato in Europe. Infestation spread from France to Belgium in 1935, to Luxemburg and Germany in 1936, and to Switzerland and Holland in 1937. Further advances occurred in 1938, and the beetle has now crossed the Vosges into Alsace, has penetrated along valleys far into the Pyrenees and the Alps, and threatens to invade Italy and Spain.

The second paper comprises a survey of measures for control. The most effective method is the collection of the adults and larvae, which destroys many new foci of infestation. Watering the soil with benzene or petrol or applying carbon bisulphide to it destroys the subterranean forms, and spraying the foliage of potato with lead arsenate, calcium arsenate, aluminium arsenate or Paris green is

effective against the larvae. Bordeaux mixture can be added to these sprays as a fungicide, but has a repellent action on the adults and is thus likely to cause the spread of infestation. When the use of arsenicals is undesirable, potatoes may be dusted with derris or cubé, but the cost of treatment is higher. The necessity is emphasised of common action if the beetle is to be controlled.

PATAY (R.). **Comment reconnaître les divers stades du doryphore (*Leptinotarsa decemlineata* Say).**—*Bull. Soc. sci. Bretagne* **15** no. 3–4 pp. 198–199, 1 ref. Rennes, 1939.

Brief notes are given on characters distinguishing the larval instars of *Leptinotarsa decemlineata*, Say, and larvae that have begun to pupate. In an investigation in Brittany on the effect of the exceptionally cold weather in December 1938 on the beetle, normal adults were found at the beginning of January 1939 hibernating about 8 ins. below the surface of the soil.

LEPESME (P.). **Sur le régime et l'importance économique de quelques Corynetidae. (Col. Cleridae).**—*Rev. franç. Ent.* **6** fasc. 1 pp. 17–20. Paris, 1939.

Of the five Corynetines recorded from France, *Corynetes pusillus*, Klug, is confined to southern Europe and, in French territory, has been found in Corsica only, but *C. coeruleus*, DeG., *Necrobia ruficollis*, F., *N. violacea*, L., and *N. rufipes*, DeG., have an almost world-wide distribution. *C. coeruleus* preys on Anobiid larvae on trees and in buildings. The adults attack pupae of *Sitodrepa* (*Stegobium*) *panicea*, L., and it is thought that individuals found in flour and similar substances are searching for *Tribolium*, *Gnathocerus* and *Oryzaephilus*, and those found in products of animal origin, such as woollen goods, for Dermestids, Ptinids and larvae of clothes-moths. It is concluded that this species is highly beneficial. The three species of *Necrobia* feed chiefly on decomposing animal matter, particularly fat that is becoming rancid, but are also predacious. *N. ruficollis* and *N. rufipes* are often found associated with *Dermestes* [*R.A.E.*, A **26** 451]. *N. violacea* and *N. ruficollis* are found on the carcasses of small mammals and birds and on bones and in salt provisions, lard, suet and cheese. On the whole, however, they are more beneficial than harmful, particularly as they never become extremely abundant, though they are pests of dried fish in India. *N. rufipes* also feeds on carcasses and bones, but is more common on fatty animal matter, particularly ham and bacon [**13** 508], and oleaginous vegetable matter, and is more harmful because at times it becomes very abundant. It is as serious a pest of salt fish in the Far East as *N. ruficollis*, and it also feeds on bone meal, dried egg-yolk and cheese, and preys on larvae and pupae of *Piophila casei*, L. [**10** 397] and other Diptera found in them. Among vegetable materials, copra is most usually attacked, though only when degenerated [**23** 440 ; **26** 31], but cacao, spices, dried fruit [**8** 330] and *Illicium verum* [**23** 706] are also infested, presumably when they are attacked by fungi. *Penicillium* and *Aspergillus* have been found suitable foods for the adults. Notes are given on the characters distinguishing the adults of the four species.

LEPESME (P.). **Recherches quantitatives sur la variation artificielle de la teneur en eau de quelques insectes et sa limite mortelle.**—*C. R. Acad. Sci.* **208** no. 22 pp. 1753–1755. Paris, 1939.

In these investigations, batches of 100 adults of *Calandra* (*Sitophilus*) *oryzae*, L., were weighed and kept in vessels containing 0·1 gm. magnesium oxide (water content 3 per cent.) at 20°C. [68°F.] and 65 per cent. relative humidity until 25, 50 and 75 per cent. had died. The results showed that mortality occurred when the water content was reduced from about 48 to 32–34 per cent. of the body weight.

[RODIONOV (Z. S.).] **Родионов (З. С.). The Regularity of Movement of *Calandra granaria* L. in a Heap of Grain.** [*In Russian.*]—*Zool. Zh.* **17** no. 4 pp. 610–616, 5 refs. Moscow, 1938. (With a Summary in English.)

The following is based on the author's summary of these investigations: In moving through stored wheat, adults of *Calandra granaria*, L., force their way between the grains, often raising them up. Their integument cannot withstand a pressure of more than 12½ oz., and hence the depth to which they can penetrate grain in containers is limited to 40–60 ins., owing to the higher pressure at greater depths. Mass infestation of grain in elevators is therefore confined to the upper layers, but it is less restricted in grain stored in heaps on the floor, in which the pressure is not so great. Grain should be stored in heaps only for very short periods and should be passed on for cleaning or grinding as soon as possible. When the grain is being released from the shafts in the elevator, it flows with great pressure, and the only weevils that will survive are those that occur at the end of the stream. These can be killed by turning this portion of the grain over or passing it again through the shafts. Special observations on infested grain in an elevator in the Caucasus showed that satisfactory control is given by rapid and repeated transfer of grain from one shaft to another. Weevils buried under a 40-inch layer of sand easily made their way to the surface, which shows that the common practice of burying them in the soil near granaries is quite ineffective.

[POLEZHAEV (V. G.).] **Полежаев (В. Г.). Influence de la faim sur la formation des hypopes enkystés chez *Glycyphagus destructor* (Schrk.).** [*In Russian.*]—*Zool. Zh.* **17** no. 4 pp. 617–621, 5 refs. Moscow, 1938. (With a Summary in French.)

In view of the resistance of the hypopial forms of grain mites to fumigation with hydrocyanic acid gas [*cf. R.A.E.*, A **25** 266], laboratory investigations on the effect of lack of food on the formation of hypopi in *Lepidoglyphus* (*Glycyphagus*) *destructor*, Schr., were carried out in Moscow. In previous work on this species, the author observed that the hypopi were less abundant when the relative humidity was 80 per cent. than when it was higher or lower. The hypopi appeared in greatest numbers in spring. These findings do not conform with the view of Hora that external factors do not affect the formation of hypopi [**22** 544]. In the experiments described, which were carried out in three series from 9th July to 17th December at temperatures varying from 17 to 24°C. [62·6–75·2°F.] and 80 per cent. relative humidity, known numbers of eggs of *L. destructor* were placed in glass

containers and the resulting mites were allowed to feed intermittently on the germinative parts of grains. In the series in which the mites fed for only one day at a time with intervals of two days, the percentage mortality averaged 86·16, the adult stage was reached by 12·70 per cent. of the individuals and only 1·14 per cent. became hypopi, the corresponding averages for individuals allowed to feed uninterruptedly being 32·50, 50·34 and 17·16. In the two other series, in which the mites were allowed to feed for two days at a time with intervals of one day, mortality averaged 86·90 and 56·18 per cent., respectively, the percentages of adults were 12·88 and 43·82, and those of the hypopi 0·22 and 0, whereas in the controls these figures were 30 and 33·40, 62·68 and 54·60, and 7·32 and 12, respectively. The author concludes, therefore, that besides increasing mortality among mites, lack of food checks the appearance of hypopi.

[Zolotarev (E. Kh.).] **Золотарев (Е. Х.). Summer and autumnal Rearing of the Chinese Oak Silkworm as influencing the Diapause of the Pupa.** [*In Russian.*]—*Zool. Zh.* **17** no. 4 pp. 622–633, 6 graphs, 5 refs. Moscow, 1938. (With a Summary in English.)

In the Russian Union, many large oak forests occur in the central zone, but climatic conditions do not permit the establishment of the Saturniid, *Antheraea pernyi*, Guér., which hibernates in the pupal stage, because, though two generations are produced during the season, almost all the larvae of the second die [*cf. R.A.E.*, A **27** 403]. Laboratory experiments were carried out in 1937 in Moscow to determine whether it would be possible to induce a diapause in the first-generation pupae and so breed a race that would produce only one generation a year. The initial material used comprised autumn cocoons obtained in November 1936 from southern Crimea ; they were kept from 1st December onwards at between + and −5°C. [41–23°F.]. Some of them were transferred to incubators in the second half of April and kept at 18, 23 or 28°C. [64·4, 73·4 or 82·4°F.]. The eggs laid by the resulting females were also kept at these temperatures, and the larvae began feeding on oak leaves in the second half of May, fresh twigs being usually supplied daily. The larvae developed at 23–27°C. [73·4–80·6°F.] and began to spin cocoons early in July. None of the pupae diapaused, which indicates that, unlike *Bombyx mori*, L., the number of generations produced by *A. pernyi* does not depend on the temperature at which the initial pupae and eggs develop. Furthermore, the diapause does not depend on the temperature at which the larvae spin cocoons and pupate, as when fifth-instar larvae were transferred in July to 14–15°C. [57·2–59°F.] and eventually pupated, all the pupae gave rise to adults when placed in incubators, and none diapaused.

Another batch of the original cocoons were not transferred to incubators until 3rd June. Some were then kept at 23°C. and others at 28°C., and of the eggs laid by the resulting females, some were kept at 17°C. [62·6°F.] and some at 27°C. [80·6°F.]. The larvae, which were kept indoors until they reached the third instar and were then transferred to an open shed, fed on oak leaves, which were, however, rather coarse and dry at that time, especially in September. The cold weather in September considerably retarded larval development, and the spinning of cocoons lasted from 16th September to 14th October, when the larvae pupated. To ascertain whether the pupae were

diapausing, 43 cocoons were kept at 25°C. and 60–70 per cent. humidity from 15th October until 10th November, a period of 25 days being normally required to complete pupal development at that temperature. None gave rise to adults at the end of this period. Normally diapausing autumn pupae in cocoons received from the Crimea also did not give rise to adults when kept at 25°C. for 25 days in November–December. All the remaining pupae were kept at low temperatures during the winter, and adults emerged in January 1938 from some that were transferred to 25°C. on 31st December.

It thus appears that though a diapause does not normally occur in first-generation pupae of *A. pernyi*, it can be induced by rearing the larvae during the summer and autumn, concurrently with those of the second generation. This diapause does not differ in any way from that observed in the autumn pupae of the second generation in a bivoltine population of the moth.

[Zvoruikina (N. A.).] **Зворыкина (Н. А.). The Ramie Pests in western Georgia.** [*In Russian.*]—*Soviet Subtropics* 1936 no. 12 (28), pp. 75–78, 1 ref. Moscow, 1936. [Recd. 1939.]

Notes are given on the bionomics of pests of ramie [*Boehmeria nivea*] observed in 1931–35 in western Georgia. They include all those mentioned in a previous paper [*R.A.E.*, A **24** 221], except *Heliothis armigera*, Hb., as well as flea-beetles of the genera *Chaetocnema* and *Longitarsus*, the Noctuids, *Laphygma exigua*, Hb., and *Emmelia trabealis*, Scop., the Tortricids, *Tortrix* (*Cacoecia*) *lafauryana*, Rag., *Eulia politana*, Haw., and *Tortrix dumetana*, Treitschke, and the Pyralid, *Pyrausta nubilalis*, Hb. Damage to ramie by *Pyrausta* occurred chiefly in the second half of September when it was due to the second-generation larvae that migrated from maize after harvest. The Tortricids were abundant on ramie in the first half of June and again in August, when most of the damage was caused, as the larvae, besides curling the leaves, gnawed the stems and injured the point of growth. Many of them were parasitised by *Macrocentrus abdominalis*, F.; other parasites observed were *Phytodietus ornatus*, Desvignes, *Glypta* sp., and *Microgaster globata*, L.

The larvae of *Vanessa* (*Pyrameis*) *cardui*, L., which not only attacked the leaves, but also often destroyed the growing point, caused serious damage in 1933 and 1935, particularly in late May and early June. There were three generations in 1933, but the second and third were practically destroyed by bacterial and fungous diseases and by various parasites. Of these, *Apanteles spurius*, Wesm., and *Sturmia bella*, Mg., were the most important, the others being *Amblyteles campelinus*, Wesm., *Microgaster subcompleta*, Nees, *Pimpla maculator*, F., *Mesochorus* sp., *Sarcophaga barbata*, Thoms., *Compsilura concinnata*, Mg., and *Voria ruralis*, Fall.

[Nevskiĭ (V.).] **Невский (В.) On the Causes of Fluctuations in Population Density of the Codling Moth** (*Cydia pomonella* **L.).** [*In Russian.*]—*Acta Univ. Asiae med.* (8, Zool.) fasc. 37, 14 pp., 6 refs. Tashkent, 1937. (With a Summary in English.) [Recd. 1939.]

In Central Asia, the abundance of *Cydia pomonella*, L., on apple fluctuates greatly from year to year; in the course of nine years

(1927–35), the percentage of infested fruits in a locality near Tashkent varied from 8·7 to 67. Investigations in this neighbourhood were carried out in 1935 on the factors that determine these fluctuations [*cf. R.A.E.*, A **25** 150]. They showed that the percentage infestation was correlated with the number of days that were favourable for oviposition, that is, on which the temperature was above 16·5°C. [61·7°F.] and there was no wind or rain during the half-hour at sunrise or sunset when the females lay their eggs. In laboratory experiments at temperatures ranging from 17·8 to 29°C. [64·04–84·2°F.], the percentage of females that oviposited was highest (79) at 20–25°C. [68–77°F.]. In the Tashkent district, the number of days with this temperature during the period of intense oviposition varies in different years from 18 to 36. Variations in relative humidity between 35·5 and 49 per cent. did not affect oviposition to any appreciable extent.

Temperature also affected the rate of development of the eggs and larvae, the percentage of larvae able to enter the apples, and possibly the percentage of full-fed larvae that diapaused. The average durations of the egg stage and the larval feeding period were shortest (5·2 and 23·6 days, respectively) in July at a mean of 27·5°C. [81·5°F.], 62 per cent. of the larvae entered the fruit at 15–20°C. [59–68°F.], as compared with 76 per cent. at 21–28°C. [69·8–82·4°F.], and only 16 per cent. diapaused in July, whereas 60 and 100 per cent. did so in the first and second halves of August, respectively, at a mean monthly temperature of 25·3°C. [77·48°F.]. In May and June, a large number of young larvae are killed by rain before they enter the fruits, and the low humidity in September–December is detrimental to the hibernating larvae, as the processes of metabolism and subsequent pupation are retarded owing to loss of water. About 20–25 per cent. of the larvae died during hibernation, particularly those exposed to frost. Full-fed larvae were devoured by birds, which picked them out from fallen fruits, and larvae sheltering in trap-bands were destroyed by a large number of predators. The egg-parasite, *Trichogramma evanescens*, Westw., which was present in this region in 1911–12, was not observed, but the Ichneumonid, *Hemiteles carpocapsae*, Kok., and the Braconid, *Ascogaster canifrons*, Wesm., destroyed 20–25 and about 10 per cent., respectively, of the larvae in 1935.

Many larvae died as a result of competition when three or more occurred in one fruit, and the survivors developed slowly and showed a tendency to diapause. The resulting pupae were light in weight, but the fertility of the moths from them was not reduced.

[Meĭer (N. F.).] **Мейер (Н. Ф.). The Biological Method of controlling injurious Insects and the Results of its Application in the U.S.S.R. (With the Addition of Material on the Races of *Trichogramma*.)** [*In Russian.*]—*Zool. Zh.* **17** no. 5 pp. 905–932, 3 graphs, 7 figs., 21 refs. Moscow, 1938.

The part played by predators and parasites in regulating the abundance of noxious insects in nature is briefly discussed, the principles of the biological method of controlling insect pests are outlined, and a brief survey is given of the successful work carried out since 1930 in the Russian Union, which includes the establishment of *Aphelinus mali*, Hald., against the woolly apple aphis [*Eriosoma lanigerum*, Hsm.] [*cf. R.A.E.*, A **21** 633; **24** 674; **25** 153] and of

the Coccinellids, *Rodolia cardinalis*, Muls., and *Cryptolaemus montrouzieri*, Muls., against the Coccids, *Icerya purchasi*, Mask., and *Pseudococcus gahani*, Green, respectively [*cf.* **24** 675], and the rearing and liberation against various Lepidoptera of the egg-parasite, *Trichogramma evanescens*, Westw. [**25** 152, 153, 395; **26** 235, 236, 356; **27** 148, 304].

In the Russian Union, the larvae of *A. mali* enter hibernation when the temperature drops to 13°C. [55·4°F.] and are then able to withstand temperatures as low as −25°C. [−13°F.]. They resume development when the mean day temperature reaches 7°C. [44·6°F.]. *C. montrouzieri* has successfully overwintered in the field in several districts in Abkhazia, and survived temperatures of −1·7, −2·7 and −7·7°C. [28·94, 27·14 and 18·14°F.]. It may not, however, be able to survive lower temperatures, and breeding in the laboratory should, therefore, be continued in winter. It has also proved effective against species of *Pulvinaria* [**27** 454, 455].

From experiments on breeding *T. evanescens* in different host eggs, the author concluded that those of *Sitotroga cerealella*, Ol., are the most suitable. Investigations in which parasitised eggs of this moth were kept for different periods at various temperatures and humidities showed that the best conditions for storing were 1–2°C. [33·8–35·6°F.] and 90 per cent. relative humidity, which gave the highest percentage emergence of adults of *Trichogramma* after the eggs had been transferred to warm conditions. Under these conditions and with eggs that contained mature larvae of the parasite, the percentages from which adults emerged averaged 92·2, 66·1, 51·9 and 52, respectively, after storage for 1, 2, 3 and 4 months. In the case of eggs containing pupae of the parasite, the corresponding percentages were 60·1, 45, 32 and 15. When parasitised eggs of *Ephestia kuehniella*, Zell., were stored under the same conditions, the percentages of parasite emergence were considerably lower, and none emerged after storage for 4 months. Breeding *Trichogramma* for several years in eggs of *Sitotroga* did not affect the attractiveness to it of the eggs of other Lepidoptera in the field.

Since 1932, nine races of *T. evanescens* have been found to occur in the Russian Union [*cf.* **27** 109]. They are indistinguishable morphologically, but differ in bionomics and ecology; some are orange in colour and others dark brown. Attempts to interbreed them have failed. Of these races, one has been named after the host and eight after the district from which the parasitised eggs were collected. They are: the cabbage-white race, which was bred in the northern Caucasus from eggs of *Pieris brassicae*, L., and is the only race that readily attacks this host; the Azov-Black-Sea race, which was bred in 1932 in northern Caucasus from eggs of the cabbage Noctuid [*Barathra brassicae*, L.] and is being extensively reared in many laboratories in Russia; the Central Asiatic race, from eggs of *Heliothis armigera*, Hb. (*obsoleta*, F.) on tomatos near Tashkent; the Azerbaijan race, from eggs of *H. armigera* in Azerbaijan; the Astrakhan race from eggs of the codling moth [*Cydia pomonella*, L.]; the Saratov race, from eggs of *Cydia* (*Laspeyresia*) *nigricana*, Steph.; the Romnui race from eggs of *Agrotis segetum*, Schiff., in northern Ukraine; and the orange and dark brown Armavir races, which were bred from eggs of Sphingids and Noctuids, respectively, near Armavir (northern Caucasus), the dark brown race being the only one that could not be induced to parasitise the eggs of *Pyrausta nubilalis*, Hb.

A description is given of investigations on the effect of temperature and relative humidity on the behaviour, fertility, sex ratio and duration of development of some of the races, from which it is concluded that the areas in which use should be made of the Central Asiatic, Azerbaijan, Azov-Black-Sea and Romnui races are those having mean monthly temperatures of 25–30°C. [77–86°F.], 21–27°C. [69·8–80·6°F.], 20–27°C. [68–80·6°F.] and under 22°C. [71·6°F.], respectively. The optimum relative humidities for these four races were found to be 73–75, 80–82, 73–75 and 80–82 per cent., respectively. At these humidities, combined with optimum temperatures, the Romnui race parasitised the highest percentage of the eggs of *S. cerealella*, while the percentage parasitism by each of the other three races was approximately two-thirds as great. In preliminary experiments, the Romnui race withstood storage at low temperatures for a much longer period than the Azov-Black-Sea race.

Essig (E. O.). **Aphids feeding on Celery in California.**—*Hilgardia* **11** no. 9 pp. 459–492, 12 figs., 43 refs. Berkeley, Calif., 1938.

Severin (H. H. P.) & Freitag (J. H.). **Western Celery Mosaic.**—*T.c.* pp. 493–547, 9 figs., 8 pls., 59 refs.

In the first paper, a list is given of 11 species of Aphids that attack celery in California, with notes on their food-plants, habits, synonymy and distribution. They are *Aphis apigraveolens*, sp. n., *A. ferruginea-striata*, sp. n., *A. apii*, Theo., *A. gossypii*, Glov., *A. heraclella*, Davis, *A. middletoni*, Thomas, *Cavariella capreae*, F., *Myzus circumflexus*, Buckt., *M. persicae*, Sulz., *Macrosiphum solani*, Kalt., for which the author uses the name *Myzus convolvuli*, Kalt. (regarding *Myzus pseudosolani*, Theo., and *Macrosiphum aucubae*, Bartholomew, as synonyms), and *Hyadaphis sii*, Koch (*xylostei*, Schr.) (for which he uses the name *Rhopalosiphum* (*H.*) *melliferum*, Hottes). The apterous and alate viviparous females of the two new species are described. *A. apigraveolens* feeds in compact colonies on the lower surfaces of the leaves of celery. *A. ferruginea-striata* has also been taken on carrot, sweet fennel (*Foeniculum vulgare*), parsley, parsnip, dill (*Anethum graveolens*) and poison hemlock (*Conium maculatum*). On celery, it usually occurs between the petioles near the base, sometimes below the surface of the soil.

Another list is given of Aphids that are known to attack celery, but either do not occur in California or have not been taken on celery there. *Aphis rumicis*, L., was taken once on celery in California, but was not reared on it.

The relation of Aphids to western celery mosaic, one of the six virus diseases of celery that occur under natural conditions in California [*cf. R.A.E.*, A **23** 696], is dealt with in the second paper. This disease is peculiar to umbelliferous plants. Varieties of celery, celeriac and carrot have been found naturally infected, and the hosts determined experimentally include dill, curled chervil (*Anthriscus cerefolium*), caraway (*Carum carvi*), coriander (*Coriandrum sativum*), and parsley. *Aphis rumicis* and all the other species of Aphids mentioned above, with the exception of *A. heraclella*, were reared on celery in field investigations and all transmitted the virus, as did six species, a list of which is given, that do not occur on celery under natural conditions, but *Diabrotica soror*, Lec., *Lygus pratensis*, L., and five species of Jassids failed to do so. An account is given of studies on the properties

of the virus, which is shown to be distinct from celery virus 1 [**22** 569], the causal agent of southern celery mosaic.

The virus was recovered by *A. ferruginea-striata* from infected parsley that showed no symptoms, and more readily by mechanical inoculation. The percentage of celery plants infected by transmission of the virus from naturally infected plants by the 11 species of Aphids varied from 2·2 to 92·5, and by mechanical inoculation from 13·3 to 88·9. *A. ferruginea-striata* is the most important vector in California when distribution and abundance on celery are considered. Except in the case of one species, alate Aphids transmitted the virus to a lower percentage of plants than apterous mature ones. Apterous Aphids of 10 species transmitted the virus to healthy celery plants during the first day after being transferred from diseased plants, but every one of the lots tested had lost its infectivity by the second day, under greenhouse conditions. Five lots of *A. ferruginea-striata* each consisting of 20 individuals infected healthy celery plants on which they were kept for 12 hours, but when they were re-transferred hourly to 8 successive sets of plants, no further infections occurred. When Aphids reared on diseased celery were allowed to remain on healthy celery plants for various periods, the period that elapsed before the different species first recovered the virus from the celery infected by them varied from 6 to 14 days. The incubation period of the disease in the infected plants varied from 4 to 16 days. Of 37 lots of Aphids, 6 recovered the virus before symptoms of the disease developed in the plants, 5 on the day on which the earliest symptom appeared and 26 from 1 to 6 days afterwards.

Control by such means as celery-free periods, modification in planting time, destruction of reservoirs of the virus, removal of infested plants, destruction of abandoned crops and spraying against the Aphids is discussed.

Service and Regulatory Announcements, January-March 1939.—*S.R.A., B.E.P.Q.* no. 138 pp. 1–54. Washington, D.C., U.S. Dep. Agric., 1939.

In Administrative Instructions (B.E.P.Q. 359 supplement no. 4) relating to Quarantine no. 48 against the Japanese beetle [*Popillia japonica*, Newm.], a treatment authorised as a basis for certification of potted plants, plants in tubs and balled or bare-rooted nursery stock consists in fumigation with 2½ lb. methyl bromide per 1,000 cu. ft., including the space occupied by the nursery stock, for 2½ hours at a soil and air temperature of at least 63°F. Provision must be made for circulating the mixture of air and fumigant and allowing it to have access to all sides of the pot or soil-ball, which shall be not more than 8 ins. in diameter ; the soil should not be saturated. The operator should use an approved gas mask.

Announcements relating to Quarantine no. 72 [*R.A.E.*, A **27** 274] against the white-fringed beetle [*Naupactus leucoloma*, Boh.] include Administrative Instructions (B.E.P.Q. 486) authorising the treatment in a similar way of plants in pots or in soil balls not exceeding 3 ins. in diameter, by fumigation for 4 hours with 1 lb. methyl bromide per 1,000 cu. ft., at a soil and air temperature of not less than 85°F., together with lists of plants that suffered severe, slight or no injury when thus fumigated, and Administrative Instructions (B.E.P.Q. 489) authorising treatment of potting soil by fumigation with 40 cc. methyl

bromide per cu. yard of soil for 48 hours in a tight container with a lid or tarpaulin cover by a method and in conditions that satisfy an authorised inspector, or by the application of live steam under pressure of 80 lb. or more per sq. in. through a grid of 1-in. pipes perforated with holes $\frac{1}{32}$ in. in diameter at the bottom of the sterilising box or truck body containing the soil, for 45 minutes or until all parts of the load reach 200°F. The layer of soil in the box shall be not more than $2\frac{1}{2}$ ft. deep.

Other information in this part includes summaries of plant quarantine restrictions in Albania, the Gold Coast, Ceylon, Korea and Bolivia, and amendments to summaries already noticed of restrictions in Italy, Rumania, Greece, Jugoslavia, Nigeria, Malaya, Australia and Jamaica.

COMSTOCK (J. A.). **Studies in Pacific Coast Lepidoptera.**—*Bull. S. Calif. Acad. Sci.* **38** pt. 1 pp. 34–35, 2 figs., 24 refs. Los Angeles. Calif., 1939.

The distribution of the Noctuid, *Callopistria floridensis*, Gn., the larvae of which feed on ferns, is briefly reviewed. It has been recorded at intervals from tropical America and from greenhouses in the United States and Canada. During 1937, an outbreak occurred on ferns in nursery greenhouses at Los Angeles, California. Treatment with a 2 per cent. Rhotonon [? rotenone] solution, 1 oz. to 4 U.S. gals. water, and the use of light-traps, for a period of several months resulted in complete control ; pyrethrum sprays were applied in one greenhouse, but they rendered the plants unmarketable. There was no sign of infestation in 1938 or 1939. This record is regarded as of importance, since the consequences of a general infestation in California, where there are many out-door ferneries, might be serious.

HATCH (M. H.). **Theophrastus of Eresos as an economic Entomologist.**—*J. N. Y. ent. Soc.* **46** no. 2 pp. 223–227, 3 refs. New York, N.Y., 1938.

The author gives extracts from a translation of the Enquiry into Plants, by Theophrastus (*circa* 300 B.C.), relating to insect pests of plants, and briefly discusses the identity of some of them.

RITCHER (P. O.). **Observation on White Grub Pupation.**—*J. Kans. ent. Soc.* **12** no. 2 pp. 64–69, 10 refs. McPherson, Kans., 1939.

Statements in the American literature on the depths at which larvae of *Lachnosterna* (*Phyllophaga*) pupate are reviewed, and it is suggested that they are inconsistent because the depth of pupation varies with the species and the type of soil and because in some cases the soil was not examined to a sufficient depth.

Observations on the depths of pupation of 320 larvae belonging to 8 species were made in 5 localities of different aspect, vegetation and soil type, which are described, in eastern Kentucky during 1936, 1938 and 1939. Tables are given showing the number of each species found in each locality, the minimum, maximum and average depths at which each species pupated, and the percentage of each of 9 species in over 11,000 adults collected in one county in 1936. The most abundant were *L.* (*P.*) *hirticula*, Knoch, which comprised over 88 per cent. of the total, *L.* (*P.*) *inversa*, Horn, and *L.* (*P.*) *futilis*, Lec. The

larvae of *L. hirticula* generally pupated several inches below the plough line (6 ins. below soil level) in all types of soil, whereas those of *L. inversa* pupated at shallow depths, and were found above the plough line in heavy soils. *L. futilis*, *L.* (*P.*) *fusca*, Fröl., and *L.* (*P.*) *bipartita*, Horn, pupated at intermediate depths. The data on the other species were too scanty for conclusions to be drawn.

It is concluded that soil factors may affect the pupation levels, but do not alter the relative positions of the various species; differences in latitude seem to have little effect on the depth at which a given species pupates.

ROARK (R. C.). **Agricultural Products as Insecticides.**—*Industr. Engng Chem.* **31** pp. 168–171, 4 figs., 5 refs. Easton, Pa, 1939.

The following is based on the author's summary: About 100 million dollars' worth of insecticides and fungicides are employed annually against insect and fungous pests causing an annual loss of three billion dollars in the United States. Although the materials now largely used for this purpose (compounds of arsenic, fluorine, lead, copper and sulphur) are of mineral origin, vegetable products are being used to an increasing extent. This is because many organic compounds are more toxic to insects but less toxic to man than are lead arsenate and other inorganic poisons. In addition to organic insecticides that exist naturally in plants, such as nicotine, anabasine, the pyrethrins, rotenone, ground-out oil and other plant oils, products derived from coniferous trees, such as pine-tar oil, are also valuable insecticides, and synthetic compounds derived from oils, alcohols, furfural and other promising plant products are now coming into commercial use as insecticides. It is conjectured that in the future insecticides will be mostly organic compounds obtained from plants now regarded as worthless weeds or synthesised from products of plant origin. The possibilities of constructive chemical research in this field are boundless and should result in numerous products of great economic value.

MAGIE (R. O.). **Controlling the Hop-vine Borer.**—*Farm Research* **5** no. 1 pp. 11, 12, 1 fig. Geneva, N.Y., 1939. (Abstr. in *Exp. Sta. Rec.* **80** no. 5 p. 658. Washington, D.C., 1939.)

The hop-vine borer, *Hydroecia* (*Gortyna*) *immanis*, Gn. [*cf. R.A.E.*, A **7** 173] caused more damage than usual in New York State in 1938, as many as one-third of the plants in some gardens being killed by it, or so weakened that rots completed their destruction. Pending further investigations on its control by means of calcium cyanide, it is suggested that the grass in and around the gardens be destroyed by ploughing or other means in late autumn or early spring.

ROMNEY (V. E.). **Breeding Areas and Economic Distribution of the Beet Leafhopper in New Mexico, southern Colorado, and western Texas.**—*Circ. U.S. Dep. Agric.* no. 518, 14 pp., 3 figs., 8 refs. Washington, D.C., 1939.

The following is based on the author's summary and conclusions: The breeding areas of the beet leafhopper, *Eutettix tenellus*, Baker, in southern New Mexico and western Texas coincide mainly with the distribution of a perennial mustard (*Lepidium alyssoides*), stands of which were found to be distributed over an area of 8,000 sq. miles,

of which they occupied 2,000–2,500 sq. miles. It begins to resprout at the crown in September, and the seed germinates in October or November. Several other food-plants of the leafhopper occur within its range, as well as in other areas to the west and south-east, but it is estimated that 85–90 per cent. of the populations that disperse northward during May and June each year hatch and mature on *L. alyssoides*. The Jassid oviposits on the mustard throughout the normal breeding season, but the numbers resulting from the first two spring generations are of chief economic importance, because most of them migrate to distant cultivated crops.

The size of the population varies from year to year and appeared to be correlated with the food-plant. Conditions unfavourable for leafhopper breeding, such as reduced abundance and lack of autumn germination of the mustard, apparently cause areas infested by spring flights to receive fewer leafhoppers, but under these conditions severe injury is often caused to autumn and winter crops adjacent to the breeding areas when the wild annuals that serve as summer food-plants have been abundant and dry, and when germination of the winter food-plant is poor.

Evidence is given indicating that cultivated districts east of the Continental Divide, as far north as the San Luis and Arkansas Valleys of Colorado, receive each spring influxes of *E. tenellus* mainly from breeding areas within the range of *L. alyssoides*. The eastern limits of spring infestations from the same source in Texas, Oklahoma and Kansas were not definitely established by surveys, but during the summer months leafhoppers can probably be found eastward to points where the annual rainfall is above 25 ins.

Autumn infestation occurred on beet grown for seed in districts adjacent to the areas usually covered by *L. alyssoides* during years in which summer food-plant conditions were favourable and *L. alyssoides* was absent from about 98 per cent. of its usual range, but not during those in which it was normally abundant.

Surveys and studies made in the breeding areas of New Mexico and Texas during 1928–36 indicate that an index of the severity of infestation to be expected in agricultural districts that are infested by migrations in May and June can be obtained by a single survey made after 1st January of food-plant conditions and leafhopper numbers in the areas covered by perennial mustard. An index for autumn crops adjacent to the mustard areas can be obtained by a similar survey after 1st August. This applies only to districts infested by migration from the perennial mustard areas. Breeding areas with annual food-plants are more unstable, and such limited observations would be of little value.

Additional breeding areas that were observed during 1937 along the foothills of the Rio Grande south-east of the areas covered by *L. alyssoides* are apparently of minor importance from the standpoint of numbers produced in spring, but they may contribute to the autumn infestation of spinach recorded from western Texas.

BUCHANAN (L. L.). **Changes of Names in Carabidae and Rhynchophora (Coleoptera).**—*Proc. ent. Soc. Wash.* **41** no. 3 pp. 79–82. Washington, D.C., 1939.

The author briefly discusses recent literature on the nomenclature of some beetles of economic importance. He points out that the

correct name for the Carabid known as the seed-corn beetle is *Agonoderus lecontei*, Chaud. (*pallipes*, auct. nec F.), the true *Carabus pallipes*, F., belonging to the genus *Agonum*, and having *A. limbatum*, Say, as a synonym. The Brenthid genus *Platystrophus*, type *minutus*, Dru., is synonymous with *Arrhenodes*, as the type of the latter, *septentrionis*, Hbst., is a synonym of *minutus*. *A. minutus* is the species known as the oak timber worm.

The author considers that *Cryptorrhynchus mangiferae*, F., and *C. gravis*, F., are congeneric with *C. lapathi*, L., but as he does not agree with the view that *lapathi* is the type of *Cryptorrhynchus*, he refers all three species to the genus *Sternochetus*, designating *C. mangiferae* as the type. Other weevils discussed are *Euscepes postfasciatus*, Fairm. (*batatae*, Waterh.), *Rhynchites* (*Merhynchites*) *bicolor*, F., and *Rhynchaenus* (*Orchestes*) *pallicornis*, Say, *Merhynchites* being considered a subgenus of *Rhynchites*, and *Orchestes* a synonym of *Rhynchaenus*.

BRANNON (L. W.). **Control of the Corn Earworm on Fordhook Lima Beans in eastern Virginia.**—*Circ. U.S. Dep. Agric.* no. 506, 14 pp., 2 figs., 2 refs. Washington, D.C., 1939.

This paper comprises a detailed account of field experiments carried out in eastern Virginia in 1935–38, inclusive, on the control of *Heliothis armigera*, Hb. (*obsoleta*, F.) on autumn sowings of a variety of lima beans (*Phaseolus lunatus*) to which it migrates from near-by maize that has dried up and become unattractive for oviposition. The chief results of the work have already been noticed from a summary [*R.A.E.*, A **26** 327]. The injury that the larvae cause to the beans in the pods is described, and the results of the various treatments that were tested in 1935 and 1936, as well as those of analyses of shelled and unshelled beans and of canned lima beans of another variety for fluorine residues [*cf. loc. cit.*] are tabulated.

From these results, the author recommends three or four applications, at intervals of a week or ten days, of a dust of cryolite, either undiluted (10–12 lb. per acre) or mixed with 40 per cent. (by weight) of sulphur or talc (20–25 lb. per acre), or of a spray containing 3 lb. cryolite in 50 U.S. gals. water. The first application should be made when most of the silks on maize near late plantings of lima beans have dried, but before the beans are in full bloom, unless earlier applications are required for the control of *Epilachna varivestis*, Muls., and applications should not be made within two weeks of harvest, to avoid the risk of harmful fluorine residues. If *Empoasca fabae*, Harr., or *Tetranychus telarius*, L., is also present, sulphur is preferable to talc as a diluent for cryolite, and wettable sulphur should be incorporated in the spray at the rate of 2 lb. in 50 U.S. gals. water.

A bait of 1 lb. cryolite mixed with 25 lb. maize meal broadcast evenly over the leaves at the rate of 50 lb. per acre at the same intervals as the other treatments is effective against *H. armigera*, but not against *Epilachna varivestis*.

FLANDERS (S. E.). **Environmental Control of Sex in Hymenopterous Insects.**—*Ann. ent. Soc. Amer.* **32** no. 1 pp. 11–26, 7 figs., 34 refs. Columbus, Ohio, 1939.

The following is taken from the author's summary: When the spermatheca in Hymenoptera is stored only with female-producing

sperms, as in the case of arrhenotokous species, it becomes a sex-changing mechanism. The sex of the egg is determined during oviposition. Since all the eggs deposited would be female if the spermatheca were stimulated regularly by their passage through the oviduct and vagina, it follows that the spermatheca in arrhenotokous species is subject to external regulation. Mated females produce offspring of both sexes, but the sex ratio is variable because the action of the spermatheca is determined by inconstant environmental factors. It appears in general that the sex ratio of the eggs is to a large extent externally induced.

The structure and operation of the spermathecae of honey bees and Hymenopterous parasites are discussed. The reflex controlling the discharge of sperms involves the spermathecal gland. The glandular fluids are apparently alkaline and serve to activate the sperms. The synchronisation of sperm and egg discharge is accomplished in the Aculeates and Chalcidoids by the opening of the sperm valve, and in the Ichneumonids and Braconids by the contraction of the enlarged portion of either the sperm duct or the gland canal. If the discharge of sperms from the spermatheca is in any degree inhibited by a high oviposition rate, an internally induced sex ratio results. Such a sex ratio may occur in gregarious parasites that deposit several eggs per host, or in solitary species ovipositing under conditions of high host density. It is apparent that the spermatheca is more frequently inactive when oviposition occurs on an unpreferred host or at a high rate of oviposition. The production of males is assured in solitary species by oviposition on the unpreferred individuals of the normal host and in gregarious species by the rapid deposition of eggs on an individual host.

HARDY (D. E.) & KNOWLTON (G. F.). **New and little known western Pipunculidae (Diptera).**—*Ann. ent. Soc. Amer.* **32** no. 1 pp. 113–124, 33 figs., 1 ref. Columbus, Ohio, 1939.

Descriptions are given of nine new species and varieties of *Pipunculus* from the western United States, and of the sexes that had not previously been described of two other species. Several of them were collected in connection with investigations in Utah on the parasitism of *Eutettix tenellus*, Baker [*cf. R.A.E.*, A **26** 127], and *Pipunculus confraternus*, Banks, var. *melanis*, n., and *P. trochanteratus*, Malloch, var. *tenellus*, n., were bred from this Jassid.

ALLEN (M. W.) & KNOWLTON (G. F.). *Aphis* **Species infesting** *Ribes* **(Homoptera : Aphidae).**—*Ann. ent Soc. Amer.* **32** no. 1 pp. 125–130, 46 figs. Columbus, Ohio, 1939.

Descriptions are given of the alate and apterous viviparous females of *Aphis neomexicanus*, Ckll., *A. ribiensis*, Gillette & Palmer, *A. ribi-gillettei*, K. & A., sp. n., and *A. varians*, Patch, and of the alate male and apterous oviparous female of *A. ribiensis*, all collected on *Ribes* spp. in Utah. *A. ribi-gillettei* was taken on currant and gooseberry. *A. neomexicanus* was also taken in Colorado, and *A. varians* in Idaho, Colorado and Oregon, its chief food-plant in Utah and Idaho being black currant.

The alate and apterous viviparous females of *A. grossulariae*, Kalt., and *A. sanborni*, Patch, are described from gooseberry in England,

and in Illinois and Pennsylvania, respectively, and the alate and apterous viviparous females and alate male of *A. ribis*, Sanborn, from *R. gracile* in Missouri.

A key to the alate females of the 7 species is also given.

Hodson (A. C.). **Biological Notes on the Egg Parasites of *Malacosoma disstria* Hbn.**—*Ann. ent. Soc. Amer.* **32** no. 1 pp. 131–136, 4 refs. Columbus, Ohio, 1939.

Although eggs parasitised by *Oöencyrtus clisiocampae*, Ashm., *Tetrastichus silvaticus*, Gah., and *Telenomus clisiocampae*, Ashm., were present in nearly all the egg-masses of *Malacosoma disstria*, Hb., collected in northern Minnesota in 1936 and 1937, an analysis of rearing records showed that these parasites did not exercise any considerable degree of control of the Lasiocampid. They were fairly uniformly distributed throughout the area infested by it, but were most numerous in the eastern part, where the outbreak had been in progress for the longest time. The relative abundance of the three species is shown in a table. The average percentages of parasitised egg-masses were 38·5 and 73·1, and of eggs, 2·3 and 7·2, in 1936 and 1937, respectively.

This low rate of parasitism of an abundant host by widely distributed parasites is discussed, and is considered to be due possibly to the physical structure of the egg-mass, since in most of those examined, the parasites were found in the marginal rows of eggs, which were often not well covered by the coating that protects the mass. Moreover, incompletely covered egg-masses were the most heavily parasitised. Investigations showed that the percentage mortality of the parasites was low, that the life-cycles of host and parasites were well synchronised, and that the latter did not require an additional host. The process of oviposition was not studied.

Further parasites that emerged during the investigations were *Ablerus clisiocampae*, Ashm., and *Trichogramma evanescens*, Westw., each of which was observed in a single sample of eggs.

De Bach (P. H.) & McOmie (W. A.). **New Diseases of Termites caused by Bacteria.**—*Ann. ent. Soc. Amer.* **32** no. 1 pp. 137–146, 20 refs. Columbus, Ohio, 1939.

The following is based largely on the authors' summary of investigations on two of several bacterial diseases that caused considerable mortality among colonies of *Zootermopsis angusticollis*, Hagen, in the course of large-scale laboratory rearing in California: Symptoms of both diseases are given. The causal organisms were shown by extensive tests to be a species of *Bacterium* and a strain of *Serratia marcescens*. The latter generally caused the head and appendages of the dead termite to turn red, and the former caused the head, especially, to turn black. In feeding and inoculation tests, the percentage mortalities caused by *S. marcescens* were 50 and 90–100, and by *Bacterium* sp. 22 and 60, respectively. Death occurred sooner after inoculation through the head capsule or in the pleural region of the abdomen than after feeding. A short historical sketch is given of the records of the occurrence of *S. marcescens* in other insects.

Bess (H. A.). **Investigations on the Resistance of Mealybugs (Homoptera) to Parasitization by internal Hymenopterous Parasites, with special Reference to Phagocytosis.**—*Ann. ent. Soc. Amer.* **32** no. 1 pp. 189–226, 9 figs., 29 refs. Columbus, Ohio, 1939.

The literature on the immunity of insects from parasitism is reviewed in detail, and experiments are described in which *Coccophagus gurneyi*, Comp., and *Leptomastix dactylopii*, How., were confined with six species of mealybugs, all of which were sufficiently attractive to the parasites to incite oviposition, although some were resistant to their development. *C. gurneyi* developed readily in *Pseudococcus gahani*, Green, which is considered to be its normal host, and fairly well in *P. adonidum*, L. (*longispinus*, Targ.) and *Phenacoccus solani*, Ferr., but *Pseudococcus maritimus*, Ehrh., and *Phenacoccus gossypii*, Tns. & Ckll., were very resistant, and *Pseudococcus citri*, Risso, was practically immune. *L. dactylopii* developed readily in *P. citri*, which is considered to be its normal host, and fairly well in *Phenacoccus solani*. A few individuals developed successfully in *Pseudococcus adonidum* and *Phenacoccus gossypii*, but *Pseudococcus gahani* and *P. maritimus* were immune.

It was observed that the attractiveness to the adult parasites for oviposition and the susceptibility to both parasites of the different hosts varied, and that the rate of development of the parasite may be influenced by the host in which it develops. Eggs and larvae that died succumbed earlier in some hosts than in others. In *P. maritimus* these dead parasites were usually surrounded by melanised sheaths, while in *P. gahani* they might remain alive for some time within phagocytic cysts, but eventually the cysts were melanised. In some resistant hosts, they became enveloped by a dense phagocytic cyst, while in others they were seldom phagocytised. Supernumerary eggs and larvae were phagocytised in some hosts and not in others. The structure of the cysts varied in the different hosts. Encystment of eggs usually took place at about the time of hatching, 48–60 and 72 hours after the deposition of the eggs of *L. dactylopii* and *C. gurneyi*, respectively.

It is concluded that the rate of development of the parasite possibly depends on the nutritive value of the body fluid of the host, that immunity may depend on qualities of the parasite rather than of the host, and that phagocytosis of the eggs in *P. gahani* and *P. maritimus* is associated with the development of the larvae within them, and is possibly initiated by substances liberated at about the time of hatching. Immunity does not depend only on phagocytosis, melanism, the character of the surface of the parasite or the inadequacy of the host as food, and is not necessarily accompanied by phagocytosis.

Summary for 1938.—*Insect Pest Surv. Bull.* **18** no. 10 pp. 657–685, 7 maps, multigraph. Washington, D.C., U.S. Dep. Agric. Bur. Ent. [1939.]

The principal insect pests that occurred in the United States during 1938 are discussed as in previous years [*R.A.E.*, A **26** 580]. Maps show the distribution of the more important ones. The greatest damage from grasshoppers occurred in dry areas of the northern Great Plains States, where repeated crop failures led to large acreages

of reverted and idle lands where *Melanoplus mexicanus*, Sauss., bred in great numbers. In the autumn of 1938, the area in 10 north-western States known to be infested with the Mormon cricket [*Anabrus simplex*, Hald.] was about 18,900,000 acres. Damage occurred on over 235,000 acres of crop land and 12,881,000 acres of range land.

In notes on the vetch Bruchid [*Bruchus brachialis*, Fhs.], it is reported that one individual of *Sphaerakis* (*Bruchobius*) *mayri*, Masi, was found in infested seeds in Oregon. This parasite had previously been recorded in the United States from North Carolina and Pennsylvania only. Small numbers of *Triaspis thoracicus*, Curt., were released against the Bruchid in North Carolina and large numbers in Pennsylvania in July. The damage done to cotton in Mississippi by the armyworm [*Cirphis unipuncta*, Haw.] was the worst for 25 years, severe injury to oats, lucerne and other crops was reported from Louisiana, Alabama and Texas in April, and wheat and oats were attacked in Oklahoma. As the season advanced, damage extended eastward to the coast of Maryland and Virginia, and as far north as Michigan and Minnesota. Along the Atlantic coast, flights were observed in New York late in May, and damage by the larvae, principally to oats, was reported from Pennsylvania northward through New England from June to August. In New Hampshire, the outbreak was said to be the most serious since 1919. There was a second generation causing injury in autumn in the middle Atlantic and central States. The vegetable weevil [*Listroderes obliquus*, Klug] was more injurious in the south-eastern States in 1938 than in any previous year, practically all vegetables except peas being severely damaged. Control measures were also necessary on tobacco in Florida. The species was recorded for the first time from an area in north-eastern Texas where tomatos are extensively grown. Cover crops in *Citrus* orchards in California were attacked early in March. The distribution of the Mexican bean beetle [*Epilachna varivestis*, Muls.] west of the Mississippi was extended, as it was recorded for the first time from Louisiana and Arkansas, and for the first time in the field from Missouri. Additional records for *Scolytus multistriatus*, Marsh., show it to be well distributed on both sides of the Ohio River where it forms the boundary between northern Kentucky and Indiana and Ohio.

Among pests of forest trees, the outbreak of *Dendroctonus ponderosae*, Hopk., continued on pines in the central Rocky Mountain region [*cf.* **25** 410], but that of the southern pine beetle [*D. frontalis*, Zimm.] on loblolly pine [*Pinus taeda*] in Virginia and North Carolina [**27** 377] had subsided. An outbreak of *D. convexifrons*, Hopk., on ponderosa pine [*P. ponderosa*] in northern New Mexico was checked. *D. brevicomis*, Lec., on ponderosa pine [*cf.* **25** 410, 416] was more injurious in Oregon and Washington in 1938 than during the two previous years, and infestations increased in California for the first time since 1934, despite two rainy seasons, which improved conditions for tree growth. Destruction of Douglas fir [*Pseudotsuga taxifolia*] by the Douglas fir beetle [*D. pseudotsugae*, Hopk.] continued to be severe in many areas of the Rocky Mountain region [*cf.* **25** 624]. *Melasoma* (*Chrysomela*) *tremulae*, F., was reported to be causing severe defoliation of aspen [*Populus tremuloides*] in extensive areas of north-western Pennsylvania, and small groups of aspens were completely defoliated in northern Minnesota. The larch sawflies, *Platycampus laricis*, Rohw. & Midd., and *P. laricivorus*, Rohw. & Midd., were recorded from northern Idaho for the first time since their first known appearance in 1921.

The Japanese weevil, *Calomycterus setarius*, Roel., was recorded for the first time from Massachusetts and was recorded also from Connecticut, Maryland and Pennsylvania [*cf.* **24** 426, etc.]. During the past 2–3 years, the rose midge [*Neocerata rhodophaga*, Coq.] has seriously threatened outdoor roses, which it injures in the same way as greenhouse roses [**6** 451]. All kinds are subject to attack, which takes place from July until the first frosts. A root weevil, *Pachnaeus opalus*, Ol., was bred from beans in Florida. This appears to be the first record of this species from a leguminous plant. *Monotoma parallela*, Lec., was taken in stored cereals in Kansas in 1934 and recorded in 1938. *Phytomyza atricornis*, Mg., was reared from artichoke (*Cynara scolymus*) in California. Mites collected in California in July 1938, of the same species as others that did considerable damage to peas in the same State in March 1922 and in the following year, were identified as *Penthaleus major*, Dug. Adults of the European Cerambycid, *Stromatium fulvum*, Villers, were reported to have emerged from the woodwork of a house at Camden, New Jersey. Individuals of *Diprion frutetorum*, F., were taken in litter under red pine [*Pinus resinosa*] in New Jersey. This appears to be the first time that this sawfly has been identified from the United States, though two specimens in the National Museum taken in New York in 1931 and identified as *Diprion* sp. are evidently of the same species.

Whelan (D. B.). **Field Crop Entomology.**—Med. 8vo, 56 leaves planographed, illus. St. Louis, Chicago, New York, Indianapolis, John S. Swift Co., Inc., 1938.

In this handbook, the main facts on the life-history, food-plants, distribution and control of the chief insects attacking maize, small grains and forage crops in the United States and the nature of the injury they cause are given as briefly as possible. Notes are also given on insect growth and development, the limitation of insect spread, and the fumigation of stored grain. The text is profusely illustrated.

Insect Pests.—*Guide to Farm Practice in Saskatchewan* pp. 65–77. Saskatoon, Dep. agric. Ext. Univ. Saskatchewan, 1939.

This is a brief survey of the chief agricultural pests of Saskatchewan. The relation of the distribution of insect pests and their local abundance to soils and weather is noted, and a key is given for the identification of the principal species or groups of pests by the damage they cause. The general principles of the control of insect pests of field crops are discussed, and sections are devoted to the bionomics and control of wireworms, cutworms, grasshoppers, and the wheat-stem sawfly [*Cephus cinctus*, Nort.], and to short notes on other insect pests of field crops, garden plants and shade trees.

Davis (J. J.). **The Relation of Technical Training to Applied Entomology in the Commercial Field.**—*Canad. Ent.* **71** no. 4 pp. 81–84. Guelph, 1939.

The reasons for the increasing scope and opportunities in economic entomology and the various branches of entomology available as a profession are briefly outlined, and the work of the pest control operator, and his training and relation to the technical entomologist are discussed [*cf. R.A.E.*, A **27** 531].

McNally (A. G.). **Notes on the Appearance of the European Earwig in Ontario.**—*Canad. Ent.* **71** no. 5 pp. 116–117. Guelph, 1939.

Forficula auricularia, L., was found to be present in large numbers in a village in Ontario in August 1938. This is the first recorded outbreak of the species in Canada east of the Rockies. The earwigs were found in practically every house and garden in the main part of the village. Signs of actual feeding were observed only in cabbages, but earlier feeding on carrot tops was reported, and maize stalks and lettuce were also infested. The date and method of introduction could not be established with certainty.

Gorham (R. P.). **The Chinch Bug in the Maritimes.**—*Canad. Ent.* **71** no. 5 pp. 119–120. Guelph, 1939.

A chinch bug that has caused injury to grasses in lawns in Nova Scotia and eastern New Brunswick for several years and which was first identified as *Blissus leucopterus*, Say, has been found to be *B. hirtus*, Montd. Injury has occurred principally near the sea. There have been small infestations in inland districts of New Brunswick, but observations extending over six years have shown that these have not developed to cause damage to an extent comparable with that caused to lawns near the sea.

Beaulne (J. I.). **Parasites and Predators reared at Quebec.**—*Canad. Ent.* **71** no. 5 p. 120. Guelph, 1939.

A list is given of 22 parasites and 3 predators bred from or observed at work on 18 species of injurious insects collected in the Province of Quebec.

Lopez Cristobal (U). *Calliephialtes argentinus* **Blanchard. Icneumonoideo de la serie parasítica enemigo del gusano de las frutas, nuevo para la ciencia y apto para la lucha biológica.** [*Ephialtes argentinus*, Blanch., a parasitic Ichneumonid attacking *Cydia molesta*, Busck, new to Science and suitable for biological Control.]—*Physis* **18** [**13**] pp. 477–486, 5 figs. Buenos Aires, 1939.

The author quotes the original description of the Ichneumonid, *Ephialtes* (*Calliephialtes*) *argentinus*, Blanch. [*R.A.E.*, A **25** 191], which he observed in April 1936 at Dolores, in the State of Buenos Aires, Argentina, parasitising larvae of *Cydia molesta*, Busck, in the terminal shoots of peach. Some shoots containing parasitised larvae were kept in the laboratory at La Plata, but no adult parasites were obtained. Ten of the parasitised larvae were placed in fruits on a medlar tree heavily infested by *C. molesta*. All the fruits from the tree were examined at the end of May ; 4 parasites had emerged and some further larvae of *C. molesta* were parasitised. Adults of the Ichneumonid subsequently emerged from these in the laboratory, and breeding was continued, with infested fruits of medlar. It appeared that this Ichneumonid has 5 generations a year. The offspring of females that oviposit in April and May overwinter in the host cocoons and emerge as adults in October and November. The developmental cycle of other generations lasted 29–33 days, and the maximum durations of the egg, larval and pupal stages were 6, 18 and 14 days. The female

paralyses host larvae in the shoots and fruits, and oviposits in them 3–4 hours later. The hosts remain paralysed for 3–4 days, after which they resume feeding, but do not pupate. The parasites pupate in the tunnels of the host. In the laboratory, 32 larvae on an average were parasitised by a single female. Unfertilised females produced male offspring. In hosts parasitised after their second moult, the development of the parasite is uncertain, and undersized adults result, many of which are not fertile.

The author concludes that *E. argentinus* may be of considerable value in the biological control of *C. molesta*, since it is easily bred in the laboratory, which *Eudeleboea lopezi*, Blanch. [**24** 639] is not. *C. molesta* has 6 generations a year in Argentina, and it is suggested that *E. argentinus* should be bred throughout the winter at a temperature of 15°C. [59°F.] on host larvae collected in summer and kept at 4–5°C. [39·2–41°F.], the resulting adults to be liberated in spring.

Insect Pests and their Control.—*Agric. Gaz. N.S.W.* **50** pt. 3 pp. 152–156, 8 figs. Sydney, 1939.

This part of a series on insect pests in New South Wales [*cf. R.A.E.*, A **27** 449] includes notes on the weevil, *Aesiotes leucurus*, Pasc., which causes die-back or leaf discoloration in conifers (*Cupressus* spp., *Pinus radiata* and *P. halepensis*) used as wind-breaks in orchards or for decorative purposes. The eggs are laid on or just under the surface of the bark, and the larvae feed between the bark and the sapwood. They pupate in cocoons made of shredded sapwood in shallow cavities in the wood. The adult is briefly described. Control measures include collecting the weevils from the foliage and bark between October and March, and painting the trunks and main branches with thick Bordeaux mixture, containing 1½ lb. copper sulphate and 1 lb. lime in 2 gals. water, before the adults emerge in spring, in order to repel ovipositing females. Injured and loose bark should be scraped off, the larvae removed and the exposed surfaces painted with the Bordeaux mixture.

Smith (J. H.). **Report of the Entomological Section.**—*Rep. Dep. Agric. Stk Qd 1937–38* pp. 29–32. Brisbane, 1938.

Some of the information contained in this report on entomological work and insect pests in Queensland in 1937–38 has already been noticed. Fruit-fly puparia, parasitised by *Syntomosphyrum indicum*, Silv., were imported from New South Wales, and the parasites that emerged were released in considerable numbers for the control of *Dacus* (*Chaetodacus*) *ferrugineus tryoni*, Frogg. In the spring, hoppers of *Chortoicetes terminifera*, Wlk. [*cf. R.A.E.*, A **26** 494] hatched in unprecedented abundance in the south-east, but control was effected by the compulsory use of a bait consisting of ½ lb. arsenic pentoxide, 4 lb. molasses, 2½ gals. water and 24 lb. bran, and loss of wheat and fodder crops was negligible. Dry weather following the bait campaign and later heavy rains also had a controlling effect ; no migratory flights were observed, and considerably less control was needed for the second generation and very little later in the season. In the autumn, adults of *Austracris guttulosa*, Wlk., and other grasshoppers were abundant in inland districts, but did not cause extensive loss.

Despite the bacterial disease of white grubs [*Lepidiota caudata*, Blkb.] in pastures in 1937 [**26** 267], there was a heavy flight of adults in the spring. *Lepidoderma* (*Lepidiota*) *albohirtum*, Waterh., caused extensive damage to maize in the drier part of the Atherton Tableland maize belt, very early planting having resulted in the maize being sufficiently advanced to attract ovipositing females. The cobs developed normally, but the collapse of the plants necessitated early harvesting to prevent the development of mould. In the central and northern districts, heavy loss was caused, particularly to tomatos, by *Nezara viridula*, L., which is established in all fruit-producing and market-gardening areas of the State. The egg parasite, *Microphanurus basalis*, Wollaston (*megacephalus*, Ashm.), which was introduced into southern Queensland from Western Australia in 1933, is well established, and the importance of the host in that region has declined. *Bucculatrix gossypii*, Turn., was widely distributed on cotton at mid-season, and *Earias huegeli*, Rogenh., caused terminal injury to early crops. *Teleonemia lantanae*, Dist., is now established in the central east coastal region against *Lantana* [*camara*], but the food-plants have not yet received any material set-back. Laboratory studies and plantation observations on *Aesiotes notabilis*, Pasc. [**26** 494] on hoop pine [*Araucaria cunninghami*] have shown that though adults may live and reproduce for a year or more, oviposition is favoured by humid weather, and there are therefore periods when pruning can be undertaken in reasonable safety. Other pests included *Laphygma* (*Spodoptera*) *exempta*, Wlk., in pasture, *Oxycarenus luctuosus*, Montr., on fruit trees, *Haplothrips froggatti*, Hood, on vines, *Dichocrocis punctiferalis*, Gn., on papaya [**26** 246] and *Citrus*, and *Tetranychus telarius*, L., on papaya. The predatory Coccinellid, *Scymnus* sp., was often associated with the mite.

VOLKONSKY (M.). **Sur le photoakinèse des acridiens.**—*Arch. Inst. Pasteur Algérie* **17** no. 1 pp. 194–220, 1 fig., 1 pl., 10 refs. Algiers, 1939.

An account is given of observations on reaction to light in *Locusta migratoria migratoria*, L., *Schistocerca gregaria*, Forsk., and *Anacridium moestum melanorhodon*, Wlk. Experiments showed that the complete immobility of locusts with the body orientated at right angles or parallel to rays of the sun was the combined result of light and heat perception [*cf. R.A.E.*, A **19** 705]. The relative importance of the two stimuli depends on the stage of development, the stimulation by light increasing with age.

In *Schistocerca* and *Locusta* exposed to the sun, the body temperature surpassed that of the air by 16–17°C. [28·8–30·6°F.] when the body was at right angles and by 6–7°C. [10·8–12·6°F.] when it was parallel to the rays. These Acridids have, therefore, an efficient means of regulating their body temperature. The temperature at which caged locusts changed their positions is termed the "preferendum body temperature." In *Schistocerca* kept at air temperatures of 30–34°C. [86–93·2°F.] and medium relative humidities, it ranged from 35–36°C. [95–96·8°F.] in the first instar to 41–42°C. [105·8–107·6°F.] in adults; in *Locusta* it ranged from 34 to 41–42°C. In both species, it was lower by 1·5–2·5°C. [2·7–4·5°F.] in phase *solitaria* than in phase *gregaria*.

Adults of *Schistocerca* and *Locusta* kept in large cages, each containing 1,000–3,000 individuals, occasionally became frantically active, flying

about the cage for several hours. Such mass flights usually alternated with periods of immobility, resulting from the effects of light and temperature, and were therefore probably initiated by some fluctuations in these factors. Agitation was particularly marked when there was intermittent cloudiness, the locusts beginning to fly whenever the sun was obscured. Flights of short duration were also observed before sunset, when they were probably provoked by rapidly decreasing radiation.

The irritability of the locusts was sometimes so strong that mass flights began in the absence of any apparent external stimulus. In the case of *Locusta* kept at relative humidities of 52–75 per cent., the average percentage humidities for the 24 hours preceding such flights were always below 65 and usually below 59. The body temperature had to be within certain limits, and in sunny weather spontaneous flights could only occur at body temperatures ranging from 35 to 45°C. [95–113°F.], at which the immobilising effect of light and heat was reduced. It follows that under natural conditions, provided that temperature is suitable, spontaneous flights would depend on the degree of relative humidity and cloudiness. As humidity below 60 per cent. favours flights, the swarms will tend to become concentrated in a zone with a humidity above that value ; similarly they will tend to leave regions where the degree of cloudiness is high [*cf.* **20** 97].

CHAUVIN (R.). **Influence du régime alimentaire sur le criquet pélerin grégaire.**—*C. R. Soc. Biol.* **131** no. 15 pp. 31–33, 1 ref. Paris, 1939.

In a series of experiments, hoppers of *Schistocerca gregaria*, Forsk., were given vegetable diets devoid of carotins and chlorophyll. Such diets retarded their development, and greatly increased mortality and cannibalism. Apparently, carotins were not formed either in hoppers or in adults, but fifth-instar hoppers acquired a pale green tinge, suggesting that locusts may be capable of forming chlorophyll themselves.

UVAROV (B. P.). **The Identity of *Chopardina importata* Uvarov, 1921 (Orthoptera, Gryllacrididae).**—*Proc. R. ent. Soc. Lond.* (B) **8** pt. 4 p. 60. London, 1939.

The author states that *Chopardina importata*, Uvarov [*R.A.E.*, A **9** 504] is a synonym of *Dolichopoda bormansi*, Brunner. The genus *Dolichopoda* comprises a number of species living in caves in the Mediterranean region. Since *D. bormansi* occurs only in a few caves in Corsica, the example from a greenhouse in England described as *C. importata* must have been brought there with plants taken in or near the caves.

NIXON (G. E. J.). **Notes on Alysiinae with Descriptions of three new Species (Hym., Braconidae).**—*Proc. R. ent. Soc. Lond.* (B) **8** pt. 4 pp. 61–67, 3 figs., 1 ref. London, 1939.

A key based on the females is given to the European species of the genus *Aphaereta*, with notes on their synonymy. Both sexes of two new species are described, one of which, *A. difficilis*, was bred from

Hylemyia (*Paregle*) *radicum*, L., on radish and turnip and *H.* (*Chortophila*) *brassicae*, Bch., both in Morocco. Descriptions are also given of both sexes of *Phaenocarpa leveri*, sp. n., bred from *Dacus* (*Chaetodacus*) *passiflorae*, Frogg., in the Fiji Islands.

Lounsky (J.) & Vanderwalle (R.). **Effets de traitements à l'oxyde d'ethylène sur plantes d'azalées.**—*Bull. Inst. agron. Gembloux* **7** no. 3 pp. 269–275, 2 figs., 3 refs. Gembloux, 1938. (With Summaries in Dutch, German and English.) **Observations sur le comportement de plantes d'azalées dans divers essais de traitement de désinsectisation.**—*Op. cit.* **8** no. 1 pp. 52–58, 3 figs., 10 refs. 1939. (With Summaries in Dutch, German and English.)

In the first paper, the effect of vacuum fumigation with ethylene oxide on azalea plants is described. Injury was very severe even when the dosage was low and exposure short, though plants that were removed immediately after contact with the gas were unharmed. When the roots were protected by immersion in water during treatment, the leaves were killed as in wholly exposed plants, but when the leaves were so protected, they died gradually several days after treatment as a result of the cessation of the functions of the roots.

The treatments discussed in the second paper are fumigation with methyl bromide, which caused no injury when used at 40 gm. per cu. m. for 1, 2 or 3 hours at reduced or atmospheric pressure, but gave irregular results at higher dosages, sometimes causing injury that was found to be chiefly due to impurities and was always more severe at the bottom of the fumigating chamber; hot water treatment, which was fatal at 50°C. [122°F.] for 70 minutes, the shortest exposure tried, and at 45°C. [113°F.] for 120 minutes but not for 90; and soaking in water containing insecticides. Of these, nicotine caused the leaves to fall rapidly at 1 per cent. for 96 hours, 3 per cent. for 24 hours or 5 per cent. for 6 hours, while the plants were killed by potassium thiocarbonate at 2 per cent. for 6 hours and at 1 per cent. for a longer time, and by Subcidine, a commercial emulsion of chloropicrin, at 1 per mille for 6 hours or 0·1 per mille for 18 hours.

Lounsky (J.) & Tilemans (E.). **Essais sur la résistance du doryphore** (*Leptinotarsa decemlineata* **Say**) **aux fumigations à l'acide cyanhydrique.**—*Bull. Inst. agron. Gembloux* **8** no. 1 pp. 59–67, 2 figs., 4 refs. Gembloux, 1939. (With Summaries in Dutch, German and English.)

A description is given of the apparatus used in experiments carried out to determine the concentration of hydrocyanic acid gas necessary to give complete mortality of adults and pupae of *Leptinotarsa decemlineata*, Say, at 16–19°C. [60·8–66·2°F.] on cardboard stands in empty flasks. The apparatus was absolutely air-tight. All non-hibernating adults were killed by exposure to 2·6 mg. HCN per litre for ½, 1, 1½ or 2 hours, but 2 out of 5 survived exposure to 2·4 mg. for ½ hour, though all were killed by the longer exposures. When a tendency to enter hibernation had been shown, exposure to 2·8 mg. per litre for 2 hours was not sufficient to give complete mortality. All pupae were killed by exposure to 5·1 mg. per litre for 1 hour, though 6 out of 10 survived exposure for ½ hour.

Frickhinger (H. W.). **Leitfaden der Schädlingsbekämpfung für Apotheker, Drogisten, Biologen und Chemiker.** [Elements of Pest Control for Pharmacists, Druggists, Biologists and Chemists.] —Med. 8vo, 331 pp., 230 figs., 1 pl. Stuttgart, Wiss. Verlagsges. m.b.H., 1939. Price *M.* 14.50.

This book is written with particular reference to the needs of chemists and others who require a brief survey of the chief pests that attack man, animals and cultivated plants in Germany and of pests in dwellings, together with information on their control. In addition to sections on fungi, worms, molluscs, birds and mammals, there is a section on Arthropods (pp. 103–262) that is largely concerned with common insect pests. These are briefly described, with notes on their life-histories and habits, and recommendations for control. In many cases, proprietary products are recommended. The disinfestation of seed and soil, spraying against fruit-tree pests and fumigation are dealt with in later sections.

Schwerdtfeger (F.). **Biologische Grundlagen der Engerlingsbekämpfung.** [The biological Bases of Measures against Cockchafer Larvae.]—*Z. Forst- u. Jagdwesen* **71** pt. 4 pp. 169–186, many refs. Berlin, 1939.

The author discusses the merits of methods that have been recommended against cockchafers (*Melolontha*). The commonest and the simplest measure is to collect the adults, but even if comparatively large numbers are taken, it can never be known with certainty what proportion of the total population these represent, and even in cases in which collection has been followed by a reduction in damage due to the larvae, it cannot be proved that this is the direct result of it. Dusting the food-plants of the adults with dinitro-cresol is a promising method, but it is still in the experimental stage [*cf. R.A.E.*, A **27** 299, 495]. Dinitro-cresol not only destroys all the adults with which it comes into contact, but as it kills the young foliage, the surviving adults die through lack of food. The plants renew their foliage rapidly, and the damage to them is no greater than that due to defoliation by the cockchafers. Control of *Melolontha* in the larval stage by means of soil fumigants or ploughing has the advantage that it can be restricted to comparatively small areas, but is difficult to achieve owing to the inaccessibility of the larvae in the soil.

The author briefly reviews the literature on the movement of the larvae in the soil, and describes laboratory experiments carried out over several years in Germany. These confirm that during the vegetation period, they move mainly horizontally from root to root, whereas during the winter they hibernate at greater depths to escape the cold. The rate at which the larvae migrated in summer was dependent on temperature, the size of the larvae and the structure of the soil. It was greatest between 16 and 24°C. [60·8 and 75·2°F.] and in large larvae. The maximum rate in second-instar larvae of *M. hippocastani*, F., was about $2\frac{1}{4}$ ins. per hour, but this rate was not maintained for long. Including periods of rest, the distances covered per day at 20°C. [68°F.] were 26 ins. for second-instar larvae and 44 ins. for third-instar larvae. From these and other observations, it is calculated that in nature a larva covers an average total distance of about 5–$6\frac{1}{2}$ ft., with a maximum of about 10–15 ft. The spread of infestation by

larval migration is therefore negligible in forests, but is of greater importance in gardens.

For purposes of control, a knowledge of the vertical migrations of the larvae in the soil is important, since those near the surface are more exposed. The author investigated this movement in *M. hippocastani* and *M. melolontha*, L., in the field in Prussia. The average depths of the inhabited soil layer for both species were between about 5 and 9 ins. in summer, and 14 and 23 ins. in winter. The extreme limits were 0·8 and 25 ins. in summer, and 5 and 43 ins. in winter. Young larvae often hibernated nearer the surface than older ones. At about −4°C. [24·8°F.] the body fluid of the larvae freezes, and in the author's observations, the larvae migrated downwards between mid-September and mid-October, when the temperature of the soil was 10–11°C. [50–51·8°F.], and came up between mid-April and mid-May, when it was 7–10°C. [44·6–50°F.]. The larvae were very resistant to variations in soil moisture, but if the absolute water content of the upper soil fell below 3 per cent., they went downwards, possibly because of the difficulty of moving in dry earth. The view that the larvae go downwards to moult could not be confirmed; moulting occurred in June–July at the usual summer depths. The larvae migrated downwards to an average depth of 14–16 ins. to pupate, and the adults remained at that depth until about the following January, when they began to move towards the surface, which they reached in April.

The weights of newly hatched and of full-fed larvae of *M. hippocastani* and *M. melolontha* averaged 28 and 32, and 1,670 and 3,190 mg., respectively, indicating that *M. melolontha* takes more food and can therefore cause more injury. Larval weight in both species increased most during the second and third summers of development, and decreased very slightly during hibernation. The increase in weight began in spring, and reached a maximum shortly after the moult. It ended in late July in 1934 and in mid-August in 1935, although the larvae did not move downwards until mid-October and late September, respectively. In 1936, it did not cease until mid-September, and the larvae moved downwards almost immediately afterwards. From these observations, the author considers that growth ceases in each season at a certain stage, after which only such food is taken as is necessary to maintain the metabolic functions. Under favourable weather conditions, and chiefly of temperature, this stage is reached early in the season, as in 1934 and 1935. If the spring is warm, damage is more intense in the earlier half of the vegetation period, particularly as the dryness that often accompanies heat hinders regeneration.

Preliminary results are given of an investigation still in progress on natural mortality in *M. hippocastani*, carried out in a forest area. At the end of June 1936, 27·6 eggs were present in the soil per square metre. In September, there were only 9·4 larvae, so that the population had decreased by 66 per cent. In May–June 1937, it was found that a mortality of 20 per cent. had occurred during the winter. By the autumn of 1937, there was a further mortality of 66 per cent., but mortality was slight during the succeeding year. In September 1938, there were only 2·3 larvae per square metre, so that natural mortality averaged 92 per cent. over the whole period.

Control of the larvae by soil cultivation offers several advantages. The larvae are not only destroyed mechanically and by exposure at the

surface, but are also deprived of food. Intermediate crops should not be planted on land that has been ploughed for the control of *Melolontha*, particularly during the first half of the season. Ploughing gives the best control when the upper soil is moist and the sun is shining.

BLUNCK (H.), MEYER (E.) & NEU (W.). **Untersuchungen über Maikäfer und Engerlinge.** [Investigations on Cockchafers and their Larvae.] —*Anz. Schädlingsk.* **15** pt. 6 pp. 61–67, 16 refs. Berlin, 1939.

The authors discuss the results of various measures applied in several districts in northern and western Germany against the cockchafers, *Melolontha melolontha*, L., and *M. hippocastani*, F., in 1938, which was a flight year in those areas. The effect of collection of the adults was inadequate, as generally only a small proportion of the estimated total population was taken, and it is considered that any great reduction in population density by collection is possible only under particularly favourable conditions and with a large number of collectors. The adults of *M. hippocastani* were not observed to move far from the districts in which they originated, but those of *M. melolontha* migrated for distances of up to 7–8 miles. Experiments against the adults in Schleswig-Holstein with preparations containing dinitro-o-cresol confirmed that dusts were not entirely satisfactory on hedges [*cf. R.A.E.*, **27** 171, 495]. Good control was given, however, by a spray, which killed all the adults with which it came into contact and some of those that arrived later. The foliage of sprayed bushes was destroyed, and they resprouted at the same time as defoliated ones. Observations on the character of the ground sought by ovipositing females were in partial agreement with previous data [**23** 742]; ground free from all vegetation and newly cultivated soil were attractive to some slight extent. Of the various repellents that were tested, the most effective was naphthalene [*cf.* **26** 346], which reduced the infestation by up to 91 per cent.

Harrowing and, particularly, ploughing destroyed large numbers of larvae in the soil. The effect of this measure can be increased by collecting the larvae or by admitting poultry to the fields. Gulls and other birds followed the plough and destroyed many larvae and adults. In one district in Pomerania, 40 per cent. of the larvae were parasitised by *Dexia rustica*, F., but infection of larvae and adults by *Beauveria* was less marked than in 1937.

ŞUSTER (P. M.). **Ueber die Raupenfliegen (Tachiniden) Rumäniens.** [On the Tachinids of Rumania.]—*Verh. 7. int. Kongr. Ent., Berlin 1938* **1** pp. 413–431, 1 pl., 1 fig. Weimar, 1939.

A list is given of 403 Tachinids, *sens. lat.* (including Sarcophagids and Calliphorids) recorded by the author in Rumania. The distribution and abundance of each species are indicated, together with the sex observed, and notes on the ecology and biology of some of the species are added.

WILLIAMS (C. B.). **The Migrations of the Cabbage White Butterfly (*Pieris brassicae*).—*Verh. 7. int. Kongr. Ent., Berlin 1938* 1** pp. 482–493, 5 figs., 21 refs. Weimar, 1939.

Early records of migrations of *Pieris brassicae*, L., in Europe are briefly reviewed, and further records of flights observed in the British

Isles and on the Continent since the publication of the author's monograph [*R.A.E.*, A **18** 691] are given. On 21st August 1938, small numbers of the butterfly were observed migrating southwards in southern Sweden. This migration is the most northerly yet observed.

The author concludes that *P. brassicae* is a regular migrant, and that the most conspicuous movement is in a southerly direction through Central Europe. The flights originate somewhere in the north. Throughout the rest of its range in Europe there are scattered records of flights, but no orderly movement can be distinguished.

[Rodd (A. E.).] **Родд (A. E.) The Cotton Worm (*Chloridea obsoleta* F.) and its Control.** [*In Russian.*]—*Trud. sredneaz. Fil. nauchno-issled. Inst. Zashch. Rast.* no. 1 pp. 3–17, 4 graphs, 1 fig., 2 refs. Tashkent, 1936. (With Summaries in Uzbek and English.) [Recd. 1939.]

Heliothis armigera, Hb. (*Chloridea obsoleta*, F.) is widely distributed in Central Asia, but up to 1926 it was abundant only in Turkmenistan, where it caused severe damage to cotton. Since 1931, however, outbreaks have occurred in Tadzhikistan and Uzbekistan, and investigations were therefore carried out in 1935 near Tashkent, in northern Uzbekistan, where tomatos are cultivated on a large scale, and in the district of Khaĭrabad, in the south, where cotton is the chief crop. Field and laboratory observations showed that there were two complete generations a year, with a partial third and fourth, the life-cycle lasting about 6 weeks. The oviposition period of the females that emerged from overwintered pupae was protracted ; eggs were deposited in May and June, but the resulting larvae were not numerous. The moths of the next two generations oviposited in early July and the first half of August, respectively. Most of the pupae of the third generation, which was the most abundant of all, hibernated ; some gave rise to adults in the beginning of September, but the resulting larvae were almost all killed by the frosts before pupating. The first-generation larvae occurred on tomatos in both the areas investigated, but the later generations in Khaĭrabad developed mainly on cotton. The adults bred in the laboratory from larvae collected in the two districts showed considerable diversity of size and coloration, but no stable variations were observed. It is concluded, therefore, that the greater infestation of cotton in the south and tomatos in the north is due to their greater availability and not to the occurrence of particular varieties or strains of the Noctuid. Infestation in 1935 was greatly reduced by parasites [*cf. R.A.E.*, A **25** 146]. Of these, the egg-parasite, which was restricted to the Tashkent district, has been identified as a species of *Trichogramma*.

The control measures have already been noticed [*cf.* **25** 146], but it is now stated that the calcium arsenate bait applied to cotton contained 3 (and not 5) per cent. calcium arsenate, and gave 74·6 per cent. mortality of third-generation larvae in 12 days, as calculated by Abbott's formula [**13** 331], in Khaĭrabad, and that 76·7 per cent. mortality of second generation larvae on tomatos near Tashkent was given in 10 days by a bait containing 10 per cent. sodium fluosilicate and applied at the rate of 45 lb. per acre. It is emphasised that baits are superior to dusts for treating tomatos, as besides giving a higher

percentage mortality, they are effective for a longer period and do not poison the crop. They should be moist, and should be scattered on the plants as soon as the first-generation larvae appear.

[Nevskiĭ (V. P.) & Shil'onok (A. A.).] **Невский (В. П.) и Шильонок (А. А.). Aviodusting Experiments in the Control of the Codling Moth.** [*In Russian.*]—*Trud. sredneaz. Fil. nauchno-issled. Inst. Zashch. Rast.* no. 1 pp. 18–41, 4 refs. Tashkent, 1936. (With Summaries in Uzbek and English.) [Recd. 1939.]

Experiments on dusting with calcium arsenate from an aeroplane against *Cydia pomonella*, L., on apples were carried out in northern Uzbekistan in 1932 and 1933. The dust contained 31–46 per cent. arsenic pentoxide and was applied at the rate of 13½ or 18 lb. per acre. The aeroplane flew at a height of 16–32 ft. above the trees, and the width of the cloud of dust varied from 52 to 72 ft. In each year, five applications were made, the first 7–10 days after the end of blossoming and the others at similar intervals. In 1932 and 1933, the first applications were made on 20th April and 5th May, respectively. For comparison, one plot was sprayed in each year with a suspension of calcium arsenate (3 lb. per 100 gals. water) applied from the ground at the same intervals and at the rate of about 4½ gals. per tree. Periodical examinations of fallen fruits and of apples on selected trees in different parts of the treated plots showed that the percentages of fruits infested were lowest in plots that were dusted at the rate of 18 lb. per acre. Spraying was slightly more effective than dusting at the lower rate.

To ascertain the percentage of larval mortality, apples from the upper, middle and lower parts of the crown of treated trees were picked 5 and 7 days after the fourth application of the dust or spray, and 1, 3 and 35 days after the fifth application. Ten newly hatched larvae were then placed on each apple. They rapidly entered the fruits, and 5 days later the apples were cut open and the live and dead larvae were counted. The results are shown in a table. The average percentage mortalities of larvae that entered apples 1, 3, 5, 7 and 35 days after they had received the higher rate of application of dust were 78·3, 69, 64·7, 55 and 29; the corresponding percentages were 55, 40·3, 39·7, 39·7 and 26 for sprayed apples, and 12, 15, 21, 8 and 18 for untreated controls tested on the same dates. The comparatively low mortalities from both dust and spray were probably due to the fact that the rates of application were too low. The distribution of the poison on the crown was approximately even, though on the whole more of both dust and spray settled in the lower part.

The author concludes that a dust of calcium arsenate could be successfully applied from an aeroplane for the control of *C. pomonella* in Central Asia. The upper parts of the crowns would receive a more even covering than when sprayed from the ground, and there is a considerable economy in labour. In districts in which strong winds prevail, dusting should be carried out in calm weather, whereas in sheltered districts the best time is the early morning, as the dust adheres better when there is dew. Provided that suitable precautions are taken, there is no danger of poisoning man or domestic animals. Though no scorching of the foliage of apples was observed in 1932 and 1933, the possibility of its occurrence in unfavourable weather should be investigated.

Jepson (W. F.). **Entomological Division.**—*Rep. Dep. Agric. Mauritius 1937* pp. 41–46. Port Louis, 1939.

In 1937, damage to sugar-cane by *Lachnosterna* (*Phytalus*) *smithi*, Arr., continued to be heavy in Mauritius, and one new centre of infestation was recorded. Some of the information on its control has already been noticed [*R.A.E.*, A **26** 316, 317]. Small numbers of the introduced Scoliid parasites, *Campsomeris annulata*, F., *C. erythrogaster*, Dalm., *C. rodriguezensis*, Bradley, and *Scolia rubea*, Bradley, were recovered from some estates. Parasites imported from South Africa included the Tachinid, *Pexopsis pyrrhaspis*, Villen., which parasitises 25–33 per cent. of the adults of the Melolonthid, *Hypopholis sommeri*, Burm., in Natal. The Tachinid parasite of *Enaria melanictera*, Klug, introduced from Madagascar against *L. smithi* [**25** 789; **26** 176] has recently been described as *Paratamiclea pallida*, Villen., var. *hova*, Villen. No evidence of its establishment has been obtained. Infestation of sugar-cane by *Diatraea venosata*, Wlk., was in general less severe than usual, owing to satisfactory rainfall. In 8,800 canes from 24 estates, the percentage infestation of stems and internodes averaged 25·6 and 11·7 [*cf.* **26** 176]. There was little parasitism of the larvae, though *Enicospilus antancarus*, Sauss., was commonly seen in the field between November and March.

At a mean temperature of 20°C. [68°F.], the life-cycle of *Aspidiotus destructor*, Sign., which threatens the coconut palm with virtual extinction in Mauritius, lasted 32 days for males and 35 for females, while that of the introduced predator, *Chilocorus politus*, Muls. [*cf.* **26** 204] lasted 19–32 days, with an average of 24. The importance of *Technomyrmex detorquens*, Wlk. (*albipes*, F. Smith) in preventing control of the scale by predators [*cf.* **26** 204] becomes considerable when the weakened trees are also infested by a species of *Pseudococcus* that it fosters assiduously. Control of this ant by grease-banding was seriously reduced by the ability of the workers to become fertile and to establish nests at the bases of the fronds. Baled tobacco in the Government warehouse was damaged by *Lasioderma serricorne*, F., which has a life-cycle of 50–60 days in summer. The predacious Clerid, *Thaneroclerus buqueti*, Lef., and an unidentified Chalcidoid parasite appeared to exert considerable seasonal influence on its numbers. *Diaspis bromeliae*, Kern., caused considerable local damage to pineapple by attacking the outer leaves. Colonies of *Chilocorus politus* were released for its control. *Pseudococcus brevipes*, Ckll., is common on pineapple, but its relation to wilt disease in Mauritius is not known. *Rodolia cardinalis*, Muls., was introduced from South Africa for release against *Icerya seychellarum*, Westw.

A list of miscellaneous pests recorded during 1937 is appended, showing the locality and month in which they were observed. They include *Brontispa limbata*, Waterh., on palms, *Xyleborus morstatti*, Hag., on avocado, *Bostrychoplites cornutus*, Ol., in *Vitex* planks, *Stromatium barbatum*, F., in fencing poles, *Maruca testulalis*, Geyer, on beans, and *Chionaspis tegalensis*, Zehnt. (preyed upon by *Chilocorus politus*) on sugar-cane.

[Beeson (C. F. C.).] **Entomological Branch.**—*Rep. For. Res. India*, 1937–38 Part I pp. 33–39. Dehra Dun, Forest Research Institute, 1939.

Notes are given on entomological work carried out in India by the Forest Research Institute during 1937–38. This included a study at

Dehra Dun of the insects attacking *Lantana*. Some species, such as *Hypena abyssinialis*, Gn. (*ignotalis*, Wlk.), which has 9 generations a year, breed continually on *Lantana*, but are prevented from increasing rapidly by wilt disease and parasites. *Platyptilia pusillidactyla*, Wlk., is of no value in checking the fruiting of the plant, and though *Agromyza* (*Ophiomyia*) *lantanae*, Frogg., which has 21 generations a year and is parasitised by 8 Chalcidoids, attacks the fruits, it does not reduce the germination of the seeds.

Two predators, the Clerid, *Opilo discodirus*, Corporaal, and the Melyrid, *Idgia melanura*, Koll. & Redt., and 11 species of parasites were observed attacking *Hypsipyla robusta*, Moore, on *Cedrela toona*, and the egg parasite, *Trichogramma minutum*, Riley, was reared and released for its control on mahogany in Madras. *Pagiophloeus longiclavis*, Mshl., also bred in the thick shoots of mahogany there. The parasitism of *Plectoptera reflexa*, Gn., on *Dalbergia sissoo* in the Punjab was studied, and *Zenillia* (*Exorista*) *picta*, Baranov, a Tachinid parasite of the larvae, was reared on them for 6 generations in the laboratory, while *T. minutum* was reared for 5 generations on the eggs. The Braconid, *Cedria paradoxa*, Wlkn., was reared on *Margaronia pyloalis*, Wlk., defoliating mulberry at Dehra Dun and liberated in large numbers for its control in the Punjab.

Work on the defoliators of teak, *Hyblaea puera*, Cram., and *Hapalia machaeralis*, Wlk., and their parasites was carried out in Madras between April and November 1937 [*cf. R.A.E.*, A **26** 765]. An unidentified species of *Trichogramma* introduced from Burma was reared on eggs of *Hapalia machaeralis*, *Diacrisia obliqua*, Wlk., and a flour moth, and released. Plugging the borer hole with tar was found to give satisfactory control of the teak borer, *Phassus malabaricus*, Moore. In the United Provinces, poles of *Pinus longifolia* felled and barked in the winter were attacked by *Platypus biformis*, Chap., before July unless they had become dry enough to be unsuitable for the development of the larvae. Storing the poles in water and drying them rapidly in the sun are considered to be the two best methods of preventing infestation. Owing to the use of flour paste in their manufacture, pith helmets are attacked by *Rhizopertha dominica*, F. Of insecticides tested for use in the paste, sodium fluosilicate (10 per cent.) was as effective as a 3 per cent. solution of arsenic pentoxide and copper sulphate (3 : 1), but both were inferior to a 3·5–4 per cent. solution of arsenic pentoxide and copper sulphate. All were more effective in protecting the helmet shapes in the factory than the treatment with copper sulphate alone at present used by army contractors.

Beeson (C. F. C.) & Bhatia (B. M.). **On the Biology of the Cerambycidae (Coleopt.).**—*Indian For. Rec.* (N.S. Ent.) **5** no. 1 iv+235 pp., 8 pls., 17 figs. Delhi, 1939. Price 10*s.* 6*d.*

The following is substantially the senior author's summary: This contribution presents the data collected during 24 years on the bionomics of 350 species of Longicorns (133 Cerambycids and 217 Lamiids) occurring in India, Burma and Ceylon. For the dry-wood borer, *Stromatium barbatum*, F., 311 food-plants are listed; *Shorea robusta* is the tree attacked by the largest number, 37 species, of Longicorns. An alphabetical list of 568 species of Indian trees, shrubs, woody climbers, etc., with their borers is appended. The food-plants of at least 250 of the species dealt with have not previously been published.

The generalisations drawn from the biological data are discussed in an introductory section under the headings: Oviposition, larval habits, body-form and food-requirements, pupation, life-cycle, emergence-period, imaginal habits and longevity. The range in the length of the life-cycle of various species is from 2½ months to over 10 years. In temperate climates the life-cycle is annual or longer; in the tropics species with annual cycles are as characteristic as are species with shorter cycles. In the majority of dead-wood borers, a brood normally consists of short-cycle and long-cycle larvae, so that development may be prolonged by multiples of the short period up to two or three years from oviposition. The season in which emergence of the adults occurs is a characteristic of the species; four emergence-periods are recognised, *viz.*, temperate summer, dry or pre-monsoon season, south-west monsoon season, and post-monsoon season. Monsoon emergences are strongly influenced by the initial date, quantity and distribution of monsoon rainfall. Three-dimensional graphs (date, percentage-emergence and rainfall) are given for two species, and two-dimensional graphs for typical examples of other types of emergence. A three-dimensional graph (temperature, humidity and length of life) is given for the imaginal longevity of *Hoplocerambyx spinicornis*, Newm.

The catalogue of the 350 species is arranged alphabetically by genera and species. Summaries or references to literature are given of the information on previously well-documented species, but for the remainder the bulk of the information is new and is recorded in detail. Much of it should be useful to entomologists in the Malayan region generally.

Liu (Chi-Ying) & Chen (Chung-Liang). **Studies on the Control of the Hibernating Larvae of the Paddy Borer,** *Schoenobius incertellus* **Walker (Lepidoptera).** [*In Chinese.*]—*Chedah agric. Quart.* **1** no. 1 pp. 57–91, 3 figs., 14 Chinese & 20 English refs. Hangchow, 1937. (With a Summary in English.) [Recd. 1939.]

Observations in China showed that over 98 per cent. of the larvae of *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.) hibernate in rice stubble, protected by silken webs and excreta. The relation of autumn ploughing to larval mortality was studied, and the data analysed by the method of analysis of variance. Autumn ploughing was shown to increase larval mortality, but the presence or absence of winter crops made no significant difference. In fallow fields, complete submergence of the stubble not later than April is effective in destroying the larvae. The duration of submergence necessary for complete mortality becomes less as the season advances. In 1935–36, 95, 55 and 35 days were required when submergence was begun in November, December and February, respectively. Submergence was more effective when preceded by autumn ploughing. If it is desired to make submergence effective against *Chilo simplex*, Btlr., and *Sesamia inferens*, Wlk., also, the surface of the water should be sprayed with oil, as these species are not protected by silk or excreta and readily float to the surface and escape. Complete control of the larvae may also be obtained by digging out the stubble with a special implement consisting of a pair of trowels on handles hinged like tongs, so that they can be worked as a grab, and burning or burying it before April.

Cheo (Ming-Tsang), Liu (Chi-Ying) & Ma (Tung-Lwen). **Studies on the Tung-oil Tree Measuring-Worm, *Buzura suppressaria* Guen. (Lepidoptera).** [*In Chinese.*]—*Chedah agric. Quart.* **1** no. 2 pp. 137–205, 13 pls., text figs., 3 Chinese & 1 English refs. Hangchow, 1937. (With a Summary in English.) [Recd. 1939.]

This is a progress report on a study of *Buzura suppressaria*, Gn., the most injurious and widely distributed insect pest of the tung-oil tree [*Aleurites*] in Chekiang, carried out at Lanchi in 1935–36. The larvae of this Geometrid defoliate the trees and reduce considerably both the weight and quality of the seeds, causing an annual loss that often exceeds 33 per cent. The eggs are laid in masses in crevices in the bark of such trees as pine and fir growing among or near the tung-oil trees, and of old tung-oil trees. The bark of young trees is too smooth for oviposition. The average numbers of egg-masses per tree within mixed stands and outside but near tung-oil tree plantations were 3·2 and 1·23 for pine and 4·6 and 1·33 for fir, respectively, and for tung-oil trees three and five years old and older, 0·12, 0·18 and 0·84. There are usually two generations a year, and sometimes a partial third, the winter being spent in the pupal stage. The egg stage in the three generations lasts about 15, 8 and 13 days, respectively, and the larval stage about 31, 24 and 44 days. About 85 per cent. of the eggs hatch. The larvae are disseminated by crawling and by the wind when hanging on a silk thread. When ready to pupate, they drop directly to the ground. The pupal stage is passed in loose soil within about an inch of the surface. In the case of the first generation, non-hibernating and hibernating individuals of the second generation and the third generation, the pupal stage lasts about 25, 20, 274 and 200 days, respectively. The adults, which usually emerge between 6 and 10 p.m., are active at night and are fairly strong fliers. They usually pair within a day or two of emergence. Oviposition begins one or more days after pairing, and females lay an average of 2,250 eggs in 1–4 batches. The average length of life of adults indoors was 10, 6 and 10 days in the three generations.

To prevent infestation, tung-oil trees should be planted at least 500 ft. from trees that are suitable for oviposition, and the cultural practice of rejuvenation by cutting through the main trunk and the growing of old trees should be limited or prohibited. The pupal chambers of a Limacodid on the trunks are also suitable for oviposition and should be eradicated. If these measures are taken, over 75 per cent. of the egg-masses can be trapped by hanging pieces of pine trunk, 2 ft. long and 3 ins. in diameter, on every second or third tree. Lead arsenate and pyrethrum are effective larvicides, but the latter is too costly to be practical. About 70 per cent. of the pupae can be trapped by loosening the soil in strips between the rows of trees before the mature larvae reach the soil, and killed by tillage.

Watanabe (C.). *Meteorus japonicus* **Ashmead, a Parasite of the Gypsy Moth, *Lymantria dispar* Linné (Hymenoptera : Braconidae).** —*Insecta matsum.* **13** no. 2–3 pp. 63–65, 9 refs. Sapporo, 1939.

The author describes the female of *Meteorus japonicus*, Ashm., of which the male is unknown, and quotes from a letter from C. F. W. Muesebeck, who considers that *M. nipponensis*, Vier., is a synonym of it. He accepts this view and gives a character distinguishing the

species from *M. pulchricornis*, Wesm. *M. japonicus* and *M. pulchricornis* are parasites of the larvae of *Lymantria dispar*, L., in Japan and Europe, respectively.

The introduction of *M. japonicus* into the United States was recorded by A. F. Burgess & S. S. Crossman in a paper already noticed [*R.A.E.*, A **18** 170], in which they state that cocoons of *M. japonicus* were obtained from larvae of *L. dispar* from Japan, and that 400 females were bred from 5 unfertilised females in the laboratory and liberated. No recoveries were made.

WATANABE (C.). **A new Species of Genus *Aphidius* Nees and Redescription of *Aphidius japonicus* Ashmead (Taxonomic Notes on Aphidiidae of Japan, I).**—*Insecta matsum.* **13** no. 2–3 pp. 81–84, 1 fig., 6 refs. Sapporo, 1939.

Descriptions are given of both sexes of *Aphidius salignae*, sp. n., a parasite of *Lachnus* (*Tuberolachnus*) *salignus*, Gmel., on willow in Hokkaido. The female of *Coelonotus* (*Aphidius*) *japonicus*, Ashm., which was found to parasitise *Lachnus* (*Pterochlorus*) *tropicalis*, van der Goot, on chestnut in Japan is redescribed, and the original description of the male is quoted. *L. tropicalis* is the first specific host record for the species. *A. japonicus* was transferred to the genus *Coelonotus* by Fahringer, but in the opinion of the present author the latter genus is of doubtful validity and should be considered a synonym of *Aphidius*.

KONO (H.) & TAMANUKI (K.). **Die Ipiden, schädlich an Sachalintannen und Ezofichten in Sachalin.** [The Scolytids injurious to *Abies sachalinensis* and *Picea jezoensis* in Sakhalin.]—*Insecta matsum.* **13** no. 2–3 pp. 88–96, 1 col. pl. Sapporo, 1939.

A list is given of 20 Scolytids that attack *Picea jezoensis* and 3 that attack *Abies sachalinensis* in Sakhalin, with notes on their distribution, frequency, and in some cases life-history. They include *Dryocoetes abietinus*, sp. n., the adults of which are described and which causes considerable damage to *A. sachalinensis* in Sakhalin and Hokkaido. It is suggested that *Ips japonicus*, Niij., which attacks *P. jezoensis* [*cf. R.A.E.*, A **22** 19, etc.], should be regarded as a local race of *I. typographus*, L.

KOIDSUMI (K.). **Experimental Studies on the Influence of low Temperatures upon the Development of Fruit Flies. XI. Can the Eggs, Larvae and Pupae of Formosan Fruit Flies develop at the Temperatures of the Autumn, Winter and Spring of the Mainland of Japan ?** [*In Japanese.*]—*J. Soc. trop. Agric.* **12** no. 2 pp. 130–150. Taihoku, 1939.

In view of the danger of the introduction into Japan from Formosa of *Dacus* (*Chaetodacus*) *cucurbitae*, Coq. [*cf. R.A.E.*, A **26** 668] and *D. ferrugineus dorsalis*, Hend., experiments were carried out in Formosa to determine whether the immature stages of these Trypetids can survive the low temperatures that they would encounter from September to April on steamers plying between Formosa and Japan and in southern Japan. Eggs, larvae and pupae were kept for 3 days at the temperatures prevailing on the steamers, and for successive periods of 5 days at the average temperatures in southern Japan for corresponding periods of 5 days during September–April. No adults

were obtained from those kept below 10°C. [50°F.]. As the temperature in southern Japan does not rise above 10°C. during the period December–February, it is concluded that these Trypetids could not become established if imported in these months.

SAITO (S.). **Some Observations on Oviposition of the Apple Red Spider.** [*In Japanese.*]—*Vol. Jub. Prof. S. Yoshida* **1** pp. 444–448, 3 figs. Osaka, Osaka nat. Hist. Soc., 1939.

Notes are given on the bionomics of the species of *Tetranychus* that is injurious to apple in Hokkaido [*cf. R.A.E.*, A **27** 209] and northern Honshu. Near Sapporo, it occurs on the lower surface of the leaves, and the females oviposit at temperatures above 20°C. [68°F.]. The adults migrate to the branches and trunks when the temperature falls to 15°C. [59°F.], and below 10°C. [50°F.] only the hibernating eggs occur there.

KARIYA (S.) & KUROSAWA (M.). **On the Utilization of the natural Enemies for the Control of** *Bruchus chinensis*. [*In Japanese.*]—*Nojikairyo-Shiryo* no. 137 pp. 89–90. Tokyo, 1939.

Brief notes are given on the bionomics of the Braconid, *Heterospilus prosopidis*, Vier., which parasitises *Bruchus chinensis*, L., in Japan. The life-cycle was completed in 12–14 and 10–13 days at 26 and 30°C. [78·8 and 86°F.], respectively. At Yokohama, the overwintered larvae pupated in April, and the adults emerged in May. The adults paired most readily at 28–33°C. [82·4–91·4°F.], and one male was observed to pair 96 times. Females oviposited up to late October, and preferred full-fed larvae of the host.

KUROSAWA (M.). **Observations on Thrips.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 137 pp. 94–101. Tokyo, 1939.

Hercothrips fasciatus, Perg., is not established in Japan, but is common on oranges imported from the United States and even Canada. It can survive the winter at Yokohama. *Phloeothrips kinugasai*, Kurosawa, occurs on orange and palm seedlings imported from Saipan and Yap in the Japanese Mandated Islands.

IWASA (T.) & SHIBUYA (T.). **Can** *Cylas formicarius* **propagate under natural climatic Conditions in Japan ?** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 137 pp. 141–143. Tokyo, 1939.

In experiments to determine whether *Cylas formicarius*, F., which infests sweet potato in the Loochoo Islands, could survive under natural conditions in Japan, it proved able to complete at least 3 generations in a year at Kobe and hibernate in the larval, pupal and adult stages in the tubers. Adults that had emerged from the tubers did not survive the winter.

SHIRAIWA (H.). **On Scale Insects.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 137 pp. 151–153, 1 fig. Tokyo, 1939.

A description is given of the adult female of *Pseudococcus citriculus*, Green, which attacks *Citrus* in the field in Japan. This Coccid has been erroneously identified as *P. adonidum*, L. (*longispinus*, Targ.), which occurs in glasshouses there but not in the open.

Miyake (T.) & Odera (S.). **Notes on the Biology of Bruchidae.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 137 pp. 154–155. Tokyo, 1939.

In experiments in Japan, the number of days required for development from oviposition to adult emergence at 20, 30 and 37°C. [68, 86 and 98·6°F.] averaged 51·3, 18·9 and 21·5, respectively, for *Bruchus* (*Callosobruchus*) *chinensis*, L., and 109, 23·3 and 23·6 for *B.* (*C.*) *analis*, F., when fed on lima beans (*Phaseolus radiatus*). For *B.* (*C.*) *phaseoli*, Gylh., it averaged 67·1 and 26·6 days at 20 and 30°C., but no development took place at 37°C. *B. chinensis* required averages of 25·4, 27·2, 30·4 and 32·2 days to complete the life-cycle at 25°C. [77°F.] on *P. radiatus*, cowpeas, *P. radiatus* var. *aureus* and peas, respectively.

Tanaka (K.). **On** *Aspidiotus chinensis*, **Kuwana.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 137 pp. 172–182, 3 figs. Tokyo, 1939.

Aspidiotus chinensis, Kuw. & Muram., all stages of which are described, occurs in Japan on orchids of the genus *Cymbidium* imported from China, causing the leaves to wither. It has 3 generations a year at Nagoya, and adult females and male prepupae overwinter. It is parasitised by an Aphelinid of the genus *Prospaltella*.

Odagaki (S.). *Rhizoglyphus echinopus* **Fum. on Lily Bulbs.** [*In Japanese.*]—*Nojikairyo-Shiryo* no. 137 p. 198. Tokyo, 1939.

Rhizoglyphus echinopus, F. & R.,is common on lilies in Kyushu, and the adults, and especially the eggs, are found in dried bulbs. Most adults in the bulbs died when exposed to a temperature of 50°C. [122°F.] for 1 hour, but some survived even at 65°C. [149°F.]. These temperatures injured the bulbs.

Illustrations of Insect Pests and Fungi of Crops. 1. *Citrus* **Insects.** [*In Japanese.*]—58 pp., 20 pls. Shizuoka, Shizuoka agric Soc., 1939.

Over 60 insects that are injurious to *Citrus* in Shizuoka are illustrated and described, and notes are given on their life-history and control.

Saito (H.). **Biology and Control of** *Rhizoecus kondonis*, **Kuw., a** *Citrus* **Pest.** [*In Japanese.*]—*Agric. & Hort.* **14** no. 7 pp. 1761–1766, 5 figs. Tokyo, 1939.

Rhizoecus kondonis, Kuw., all stages of which are described, is widely distributed on the mainland of Japan. It attacks the rootlets of *Citrus*, sometimes causing the leaves to fall. In Hiroshima Prefecture, it has 3 generations a year and overwinters as an almost full-grown nymph. The nymphs resume activity in late March. Reproduction begins in late April, and females deposit 36–176 eggs (126 on an average) in a mass during 8–16 days. The eggs hatch in 11–15 days. This Coccid also occurs on *Portulaca grandiflora*, chickweed (*Stellaria media*) and a geranium (*Pelargonium inquinans*). Chloropicrin and calcium cyanamide are effective for control, but injure the trees, while carbon bisulphide is less effective. A water solution of cyanide (0·7 per cent. in winter and 0·3 per cent. in summer) gives good control and does not injure the trees.

KUWAYAMA (S.) & OSIMA (K.). **Great Outbreak of the winged Locust, *Eirenephilus longipennis* Shiraki in 1938 in the Province of Tokati, and the actual Results of its Extermination.** [*In Japanese.*]—*Oyo Kontyû* **1** no. 6 pp. 251–268, 2 pls., 7 figs. Tokyo, 1939.

In Hokkaido, the Acridids, *Eirenephilus longipennis*, Shir., *Podisma sapporensis*, Shir., and *Miramella* (*P.*) *mikado*, Boliv., sometimes appear in large numbers and cause serious injury to plants. *E. longipennis*, all stages of which are described, was very abundant in May and June 1938 in Tokati, Hokkaido; methods that gave good control of the hoppers included digging trenches, burning, collecting, and the destruction of wild grasses. Petroleum oil as a spray gave 90 per cent. mortality, but was not so effective in the form of a diluted emulsion. A spray containing 3 lb. pyrethrum, 2 lb. soap and 48 gals. water gave 36 per cent. mortality, but many more hoppers were paralysed by it.

E. longipennis has one generation a year; the eggs overwinter and hatch in May, and the adults occur from July to early October. The nymphs are gregarious and remain motionless on or near the ground during the night, but ascend trees in the early morning. The adults occur sporadically, and can fly for up to 50 yards at a time. This Acridid is known to feed on 47 species of plants and causes serious injury to over 20, including various beans, *Arctium lappa*, elm, alder and *Prunus*. A small percentage of the nymphs were attacked by a Dipterous parasite.

MORIYAMA (T.). **On Wood Ash as a Repellent against Insect Pests.** [*In Japanese.*]—*Formosan agric. Rev.* **35** no. 7 pp. 500–504, 1 fig. Taihoku, 1939.

An account is given of laboratory experiments with wood ash as a repellent against adults of *Ceratia* (*Rhaphidopalpa*) *similis*, Ol., which causes serious injury to cucurbits in Formosa. They did not feed on cucumber leaves dusted with ash in either dark or light rooms, but accepted leaves wetted with water filtered after the ash had been steeped in it. The repellent action of the dry ash is thus apparently due to physical causes.

SONAN (J.). **On the Lady-bird Parasite, *Perilitus coccinellae* Schr. (Braconidae).** [*In Japanese.*]—*Trans. nat. Hist. Soc. Formosa* **29** no. 192 pp. 225–229, 2 figs. Taihoku, 1939.

A description is given of the adult of *Perilitus coccinellae*, Schr., a parasite of adult Coccinellids, with lists of the hosts from which it has been reared in Formosa and of those from which it has been recorded in the literature.

AOYAMA (T.). **Life-history of *Nymphula vittalis* Bremer in Korea.** [*In Japanese.*]—*Rep. Jap. Ass. Adv. Sci.* **14** no. 2 pp. 320–323, 4 figs. Tokyo, 1939.

The aquatic larvae of *Nymphula vittalis*, Bremer, all stages of which are described, feed on rice and other plants in Korea, the damage caused being most severe in May. This Pyralid has one generation a year. The larvae hibernate in the rice stubble, 15–26 occurring together in shelters that they construct from fragments of the plant.

They can survive temperatures as low as —11°C. [12·2°F.]. They resume activity in mid-April, cutting the buds of the rice seedlings at the base and eating them in their shelters. They pupate in early June, and the adults emerge 10–14 days later. Females deposit 15–26 eggs in a mass on the stems of *Cyperus* or rice. The eggs hatch in 12–13 days. Natural enemies include carp and dragonflies. The larvae may be controlled by applying calcium cyanamide and by destroying the stubble.

OKAMOTO (D.). **On the Life-history of** *Galerucella distincta* **Baly (Chrysomelidae).** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 85–94, 3 figs. Tokyo, 1939.

An account is given of the bionomics of *Galerucella distincta*, Baly, on strawberry in Korea, where it has 2–4 generations a year. The adults hibernate under fallen leaves or among grasses and resume activity in April at a temperature of 7–8°C. [44·6–46·4°F.]. The females begin to oviposit in mid-April and survive until early July. Oviposition does not occur after mid-September, and the adults go into hibernation when the number of hours of light per day falls to about 13. The larvae and pupae and the adults that emerge after October do not survive the winter. The egg, larval and pupal stages last 9–19, 13–47 and 3–7 days, respectively, and development can take place at temperatures only a little above 8°C.

FUKAYA (M.). **Breeding Experiments on** *Ephestia cautella* **Walk. with Soy-bean Refuse and Rice Bran.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 96–98. Tokyo, 1939.

The eggs of *Ephestia cautella*, Wlk., are used in Japan as hosts for the mass rearing of *Trichogramma japonicum*, Ashm., an egg parasite of the rice borer [*Chilo simplex*, Btlr.]. In laboratory experiments at 24°C. [75·2°F.], the larval and pupal stages of the moth were somewhat shorter, larval mortality a little lower and the percentage of adult emergence a little higher when the breeding medium was soy-bean refuse than when it was rice bran, but the resulting females weighed slightly less and deposited fewer eggs than those bred in rice bran. The numbers of eggs obtained were 16,095 from 150 gm. soy-bean refuse and 10,249 from 60 gm. rice bran. The egg stage lasted 4 days.

HAMA (T.). **On the Percentage of Parasitisation of** *Trichogramma japonicum* **Ashm. in the Eggs of** *Chilo simplex* **Butl. in the Rice Bed.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 98–102. Tokyo, 1939.

Observations in a rice-field in Kanagawa Prefecture in May–July 1938 showed that an average of 57·0 per cent. of the egg-masses of *Chilo simplex*, Btlr., and 20·7 per cent. of the eggs were parasitised by *Trichogramma japonicum*, Ashm. [*cf. R.A.E.*, A **26** 669]. The total mortality of the eggs averaged 43·3 per cent. Of the adults of *T. japonicum* that emerged, 80·1 per cent. were females, which is considerably more than usual. The percentage parasitism usually increases as the season advances, but in 1938 this tendency was less evident. This was probably due to the restricted number of host eggs available to the females of the overwintering generation and also

to climatic conditions, a comparatively high temperature favouring the activity of the parasites early in the season, and low temperatures checking it later. The percentage of females is generally in inverse proportion to the percentage of parasitism.

Ishii (T.). **On natural Enemies of** *Chilo simplex* **Butl. and** *Schoenobius incertellus* **Walk. in Oriental Countries.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 106–109. Tokyo, 1939.

Annotated lists are given of the 35 parasites of *Chilo simplex*, Btlr., known to occur in southern and eastern Asia and of 16 parasites of *Schoenobius bipunctifer*, Wlk. (*incertellus*, Wlk.).

Kuroda (H.) & Akashi (M.). *Anophia leucomelas* **L. and the Injury it causes.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 114–116. Tokyo, 1939.

Notes are given on the bionomics of *Anophia leucomelas*, L., which was abundant on sweet potato in Nagasaki Prefecture in 1937 and 1938 [*cf. R.A.E.*, A **27** 445]. It caused crop losses of up to 60 per cent. Fifth-instar larvae consumed on an average 253 sq. cm. of leaves.

Ozaki (S.). **On** *Chlorops oryzae* **Mats.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 119–122. Tokyo, 1939.

In Aichi Prefecture, Honshu, *Chlorops oryzae*, Mats., is very injurious to certain varieties of rice, especially to the unopened ears. It has 3 generations a year, and overwinters in the larval stage in wild grasses. The damage is most serious in the vicinity of houses or forests.

Watanabe (C.). **On the parasitic Wasps of Fruit Flies attacking Cherry.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 123–128. Tokyo, 1939.

Cherries in northern Japan are attacked, sometimes seriously, by a Trypetid of the genus *Euphranta*. In Hokkaido, the larvae in the fruits are parasitised by the Braconid, *Diachasma* (*Opius*) *aino*, Watan. [*R.A.E.*, A **27** 338], and a Miscogasterid of the genus *Halticoptera* has been reared from the pupae. Notes from the literature are given on the fruit-flies of the genus *Rhagoletis* that infest cherries in Europe and North America and on their parasites.

Onoe (T.) & Fukuda (J.). **Effectiveness of Pyrethrum against the Eggs of** *Chilo simplex* **Butl.** [*In Japanese.*]—*Oyo Dobuts. Zasshi* **11** nos. 3–4 pp. 146–147. Tokyo, 1939.

Experiments in Japan showed that pyrethrum extracts in 0·5 per cent. soap solution are more effective against eggs of *Chilo simplex*, Btlr., that are a week old than against those that are a day old. Since developed embryos were observed in all the eggs that were killed, it is considered that the pyrethrum affects the embryos in a late stage of development. A solution with a pyrethrin content of about 0·009 per cent. killed all the eggs.

Pussard (R.) & Nepveu (P.). **Méthodes de lutte applicables au *Rhytidoderes plicatus* Ol.**—*C. R. Acad. Agric. Fr.* **25** no. 12 pp. 487–492, 1 ref. Paris, 1939.

An account is given of preliminary investigations on the control of *Rhytidoderes plicatus*, Ol., attacking the roots of cauliflower in the south of France [*R.A.E.*, A **27** 458]. This weevil appears to prefer a dry habitat, and since many of the infested fields could be artificially flooded with river water to increase the fertility of the soil, investigations were made in the laboratory on the effect of submersion on the larvae and adults. They were enclosed in small muslin bags, and covered with water. After 10 days, the percentages of dead larvae and adults were 60 and 40, respectively, at a temperature of 2°C. [35·6°F.], and 100 and 50, respectively, at 9–10°C. [48·2–50°F.]. At 25°C. [77°F.], all larvae and adults were killed by submersion for 4 and 3 days, respectively. Since the adults float and would be washed away under natural conditions, it is recommended that the field should be flooded when temperatures are high and the number of adults present is low; these conditions are fulfilled, and the operation can conveniently be carried out, between 20th June and 10th July.

Insecticides against the eggs would be difficult to apply and are likely to be ineffective, as the oviposition period is fairly long and the eggs are scattered over the surface of the ground and more or less covered with soil. In experiments, all eggs were killed by exposure to a temperature of 48°C. [118·4°F.] for 2 minutes or 50°C. [122°F.] for 20–30 seconds. These temperatures could be obtained under field conditions by using flame throwers or burning débris on bare soil.

Trials with carbon bisulphide as a soil fumigant against the larvae were made in a clay soil, very deficient in lime, of which the total porosity was found to be 62·76 per cent. Injections were evenly distributed over the experimental ground, at the rate of 2 per sq. metre, and larvae and adults in wire gauze cages were buried at depths of 5–55 cm. at points equidistant from the points of injection. The temperature of the soil at depths of 20 and 5 cm. varied between 5 and 10°C. [41–50°F.] and 6 and 15°C. [42·8–59°F.], respectively. Applications at the rate of 300 gm. per sq. m. gave complete mortality at the end of 8 days at all depths except 5 cm., where the mortality was 80 per cent.; at lower rates (75 and 150 gm.) the results were unsatisfactory. The lateral diffusion and retention of the fumes in the soil were investigated by a method depending on the formation of potassium xanthate by carbon bisulphide and an alcoholic solution of potassium hydroxide. The carbon bisulphide was applied at the rate of 300 gm. per sq. m., and samples were taken at a depth of 30 cm. After three days, the presence of fumes was detected at a distance of 1·5 m. from the limit of the treated area, after a week traces were found at a distance of 3 m., and after 15 days the maximum distance covered was 3·5 m.; the quantity of the fumes that penetrated a distance of 2 m. in a week was estimated to be equivalent to an application of 5 gm. per sq. m. Within the treated area, about the same quantity could still be detected after 20 days.

By this method, it would be possible to determine the period that should elapse between fumigation and planting with cauliflower, and the minimum distance that should be left between the treated area and the hedges, generally of *Cupressus*, that serve as wind breaks in Provence.

Chloropicrin gave unsatisfactory results against adults and larvae, even at the high rate of 20 cc. (33 gm.) per sq. m.

Cairaschi (E. A.) & Grison (P.). **Action des froids anormaux de l'hiver 1938–1939 sur divers insectes nuisibles de la région parisienne.**—*C. R. Acad. Agric. Fr.* **25** no. 14 pp. 537–541, 3 refs. Paris, 1939.

From a study of the effect of the abnormally cold winter of 1938–39 on insects of economic importance hibernating in the neighbourhood of Paris, it is concluded that although it was immediately preceded by particularly mild weather, this cold period did not significantly decrease the numbers of insect pests common in the region. Detailed observations were made on Aphids and *Leptinotarsa decemlineata*, Say. Numerous apterous individuals of *Brevicoryne brassicae*, L., were found dead on the upper surface of cabbage leaves on 19th December after 12 hours at −7·5°C. [18·5°F.], but after another six days with temperatures ranging from −7·5 to −15°C. [5°F.], numerous live individuals were still present in sheltered positions among the central leaves. Apterous individuals of *Myzus* (*Myzodes*) *persicae*, Sulz., on cabbage were relatively unaffected. *Eriosoma lanigerum*, Hsm., was consistently found alive in the rough bark of young branches of apple trees. Eggs of *Aphis pomi*, DeG., taken from apple after the close of the cold period, hatched normally in the laboratory, and large numbers hatched in nature at Versailles after 5th April. Aphids of the above species, brought in some cases slowly and in others rapidly to −10°C. [14°F.] and kept at that temperature for a week, became torpid, but when restored to temperatures of 15–18°C. [59–64·4°F.], they resumed normal development.

Observations on *L. decemlineata* showed that the beetles usually entered the soil when the temperature of the air was 10–14°C. [50–57·2°F.] and became inactive when the soil temperature fell below 2°C. [35·6°F.], by which time they had reached a depth of about 8 ins., unless stopped by the hard subsoil. The soil seldom froze to a depth of more than 7 ins., and the insects, unaffected by the cold, came to the surface in the normal way at the beginning of April. Only individuals that had hibernated at less than the normal depth were killed [*cf. R.A.E.*, A **27** 584]. Laboratory experiments showed that a temperature of −8°C. [17·6°F.] for at least 3 days was necessary to kill vigorous adults.

During the cold period, live individuals of many other species were observed, including various Coleoptera, Aleurodids, Syrphid larvae, and hibernating larvae of *Cydia pomonella*, L. In laboratory tests, all the species observed alive in nature resisted temperatures of −10°C. for a week or more.

Feytaud (J.) & Chaboussou (F.). **A propos de dégats causés par *Cantharis obscura* L. sur les fleurs des arbres fruitiers.**—*C. R. Acad. Agric. Fr.* **25** no. 15 pp. 580–584. Paris, 1939.

Beetles reported to be attacking the flowers of fruit trees over an area of about 7 sq. miles in south-western France in 1938 were identified as the Telephorid, *Cantharis obscura*, L.

The infestation had been in progress for several years. The beetles become very abundant in April, when they attack the stamens and pistils of flowers of plum, pear, cherry, quince and apple trees

successively as they come into bloom, often causing the total failure of the crop. They later attack the young fruits, especially those of peach, which develop too early to be attacked in the flowering stage and the downy surface of which seems particularly attractive. Their activity continues for about a month. In April 1939, they were seen also on flowers of maple, lupin and bean, and on rose buds. Moreover, young pear trees were stripped of their leaf buds, and shoots of lilac and rose were severely injured, though vines were not attacked. *C. rustica*, Fall., and *C. livida*, L., were also present in small numbers, but were unimportant. Kerosene, cresyl, common salt, sulphur and arsenic were applied by growers for control, but without success. In tests in 1939 with sprays of nicotine, rotenone and pyrethrum extract, and dusts of talc containing 0·75 per cent. rotenone from *Derris elliptica* and of a mixture of sulphur and lime, the best results were given by the rotenone dust.

POTTER (C.). **The Occurrence of** *Tribolium destructor* **Uytt., in Seeds in England.**—*Ent. mon. Mag.* **74** pp. 114–115, 6 refs. London, 1939.

Beetles found in a warehouse in England infesting *Lantana* seed imported from Italy were identified as *Tribolium destructor*, Uytt., which has not previously been recorded from this country. Records of its occurrence elsewhere are quoted from the literature [*cf. R.A.E.*, A **22** 229; **23** 524; **25** 280], and a record from Argentina is added. It is suggested that this Tenebrionid has only recently become a pest of stored products and that it may become serious.

A key is given to the adults of *T. destructor*, *T. confusum*, Duv., and *T. castaneum*, Hbst., and characters distinguishing *T. madens*, Charp., from them are appended.

PAPERS NOTICED BY TITLE ONLY.

[LEBEDEV (M. I.).] **Лебедев (М. И.). Chemical Bands in Control of Codling Moth** [*Cydia pomonella*, L., on apple in Uzbekistan]. [*In Russian*].—*Trud. sredneaz. Fil. nauchno-issled. Inst. Zashch. Rast.* no. 1 pp. 42–49, 8 figs., 3 refs. Tashkent, 1936. (With Summaries in Uzbek and English.) [Recd. 1939.] [*Cf. R.A.E.*, A **25** 150.]

[SINEL'NIKOVA (Z. S.).] **Синельникова (З. С.).** *Cemiostoma* [*Leucoptera*] *scitella* **Z. (Order Lepidoptera)** [on apple in Uzbekistan]. [*In Russian.*]—*Trud. sredneaz. Fil. nauchno-issled. Inst. Zashch. Rast.* no. 1 pp. 50–75, 6 figs., 4 refs. Tashkent, 1936. (With Summaries in Uzbek and English.) [Recd. 1939.] [*Cf. R.A.E.*, A **25** 150.]

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SILVESTRI (F.). **Descrizione di una nova specie di** *Margarodes* **(Insecta: Coccidae) del Brasile.** [Description of a new Species of *Margarodes* from Brazil.]—*Boll. Lab. Ent. agrar. Portici* **2** pp. 421–423, 2 figs. Portici, 1939.

WATANABE (C.). *Rhogas praetor* **Reinhard as a Parasite of** *Smerinthus planus* **Walker** [in Japan]. **(Host Record of Braconidae, II).**—*Insecta matsum.* **13** no. 2–3 p. 51. Sapporo, 1939.

TAKAHASHI (R.) & KANDA (S.). **A new Genus and Species of Coccidae from Japan (Hemiptera)** [*Idiococcus bambusae*, gen. et sp. n., on bamboo].—*Insecta matsum.* **13** no. 2–3 pp. 52–55, 2 figs. Sapporo, 1939.

WATANABE (C.). **A Braconid Parasite** [*Microbracon* (*Bracon*) *abscissor*, Nees] **of the Soybean Pod Borer,** *Grapholitha* [*Cydia*] *glycinivorella*, **Matsumura, in Hokkaido (Hymenoptera : Braconidae).**—*Insecta matsum.* **13** no. 2–3 pp. 61–62. Sapporo, 1939.

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RAMCHANDRA RAO (Y.). **Locusts in India and their Control.**—*Agric. Live-Stk India* **9** pt. 3 pp. 233–247, 15 refs. Delhi, 1939. [*Cf. R.A.E.*, A **19** 136 ; **25** 161, 681 ; **27** 559.]

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CONTENTS.

CONTENTS—*cont.*

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